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DEMOCRACY AND SCHOLARSHIP

THE most noteworthy fact in nineteenth century history is the onward sweep of democracy. It has shown itself not only in the formal establishment of republican forms of government, but in the virtual establishment of the power of the people in countries where aristocratic and monarchic forms of government have been maintained. Broadly speaking, democracy has established itself in many directions, if not in the complete absorption of political power, in monarchic England and in imperial Germany, as truly as in the republican United States of America. It has made its way sometimes by violence, as in the revolutions which in the middle part of the last century agitated various countries of Europe; but, generally speaking, its greatest progress has been by agitation, education and constitutional methods. Nor is the movement stopped. It is rather going on with increased momentum. The world is destined to see more democracy among a larger number of people and over still wider areas and in more countries than is the case now. The masses are demanding a wider recognition, through a more extended suffrage, in Germany, in Portugal, in Austria-Hungary, in Russia, in Persia and in India. Indeed, they have already won it in Austria-Hungary, and it is unlikely that the worn-out machinery of the old Russian government can stand much longer in their way.

Democracy has not won its way, however, without arousing a good deal of criticism and many somewhat doleful prognos-

tications of the evils that its success will surely bring in its train. There are prophets, not a few, crying in the wilderness of exploded political and social conditions that the success of democracy means the decay of refinement, the destruction of the higher ethical, intellectual and spiritual motives and ambitions; and the substitution of the gray gloom of mediocrity, in all departments of life, for the brilliant, if sometimes flaunting, diversity and exuberance of talent and activity that are fostered in the supposedly more genial atmosphere of an aristocracy. Nor are these critics of democracy so unimportant as to deserve scant attention. It is not necessary to go back to the great names of Aristotle and the many other critics, who, during the dark period of the suppression, or non-existence, of democracy found the richest and best of human existence in its absence. Within the limits of the nineteenth century we find many brilliant names in the list of those who deprecate the success of the democratic movement, and insist that the richest fruits of civilization can not be gathered in a democratic society.

It is doubtful whether we can find a more incisive presentation of the comparative merits and demerits of aristocracy and democracy in the literary pyrotechnics of Lecky, the crystal clear and cold presentation of Matthew Arnold, the dispassionate scientific exposition of Herbert Spencer, or the historical ponderosity of Sumner Maine, than is given in the simple but brilliant passage from De Tocqueville in which, while displaying an affectionate regard for democracy, he dwells with a lingering fondness on the advantages of aristocracy. He remarks:

> If it be your intention to confer a certain elevation upon the human mind, and to teach it to regard the things of this world with generous feelings; to inspire men with the scorn of mere temporal advantages; to give birth to living convictions, and to keep alive the spirit of honorable devotedness; if you hold it to be a good thing to refine the habits, to embellish the manners and cultivate the arts of a nation, and to promote the love of poetry, of beauty and of renown—if you believe such to be the principal object of society, you must avoid the government of a democracy. But, if you hold it to be expedient to divert the moral and intellectual activity of man to the production of comfort, and to the acquirement of the necessaries of life; if a clear understanding be more profitable to men than genius; if your object be not to stimulate the fruits of heroism but to create habits of peace; if you had rather behold vices than crimes and are content to meet with fewer noble deeds, provided offences be diminished in the same proportion; if, instead of living in the midst of a brilliant state of society, you are contented to have prosperity around you—if such be your desires, you can have no surer means of satisfying them than by equalizing the conditions of men and establishing democratic institutions.

Of all the theoretical criticisms that have been directed, or are now directed, against democracy, we are concerned for our present purpose only with that which alleges the hostility of democracy to scholarship and its manifestations in culture, literature, art, poetry and philosophy—the intellectual and spiritual essence of civilization. We turn, therefore, to inquire a little more closely into this so-called incompatibility.

It is asserted with much show of logic and much parade of evidence that democracy and scholarship are irreconcilable. The brilliant critic of democracy in America in its early days has remarked that high scholarship can not flourish in a democracy, since the desire of democracy is to utilize knowledge and not to discover it. He asserts that the pure passion for knowledge "can not come into being and into growth as easily in a democratic as in an aristocratic society, for the reason that men's minds are in a constant state of agitation in a democracy, that prolonged meditation is impossible, and that men are

more intent on knowing what will be of material benefit then on discovering truth from the love of it." One defendant of democracy, overwhelmed with the sense of its failure in this respect, tells us that "aristocracy distributes political power and rewards in favor of intelligence and at the expense of justice; democracy distributes them at the expense of intelligence, while trying, perhaps unsuccessfully, to satisfy the claims of justice."

It is hardly worth while to spend time criticizing the somewhat preposterous statement that aristocracy favors culture more than democracy. For, in the first place, aristocracy as a form of government and of society has had a far longer lease of life in the world's history than has democracy, so that a fair comparison can not be made. Moreover, we certainly can not say that the members of any aristocracy have been the developers of culture, or its exponents. It is probably true that more of them have been devoted to the racing track than to poetry and art, and to the exploitation of the rest of society by war and government than to the promotion of their interests by letters and the arts. The long list of names great in science, art, poetry, literature and philosophy is composed largely if not mainly of those of poor men of the middle or lower class. The only sense in which it can be claimed that an aristocracy is favorable to culture is that its members act as patrons of culture and have aided its devotees. But the claim is too great, if it is meant to be exclusive. The heroes and martyrs of civilization have as often gnawed crusts and fed on crumbs as they have sat at the banquet table of aristocracy as equals. What aristocrat paid for the Acropolis? Was it the classes or the masses that inspired Watt, Fulton, Shakespere, Milton, Kant, Voltaire?

When one sits in that little room in Dresden and feels stirring within himself the spiritual ideals of a hundred generations of his race, is he to feel grateful to any aristocracy or to any aristocrat for the immortal work of Raphael? Is it not rather true that that great work is the expression of the spiritual ideals and life of the common people and that it was made possible by the beneficence of that great democratic institution, the Roman Catholic Church? The possession of wealth, whether in railroad bonds or broad acres, does not prepossess its owner in favor of culture. That is a matter of the spirit. If the spirit is present the leisure that wealth gives aids, to be sure, but it never can create, culture.

Later prophets warn us that democratic materialism, commercialism and the demand for the practical are killing pure science and throttling literature. But yesterday a Cassandra voice in our midst announced that there is no scholarship in this democratic country of ours, and a representative of a people, many of whom like to claim that there is no scholarship but among themselves, proposes to promote it here by killing off two thirds of the professors in our university. When these critics are told to look about them and see what this democratic people of ours is doing to promote higher education and to stimulate scholarship and research by their great public school system and their state universities, unable to deny the facts, they take refuge in a subterfuge. They tell us, as an eastern university president did, not long since, that while it is true that many of the states are promoting higher education, it is a kind of higher education which is not consonant with, but antagonistic to, culture. We are told that the state universities may develop practical education, that from them we may look for great results in engineering and in agriculture, and in all those matters which are sometimes criticized as "bread and butter"

studies; but for things of the spirit, for the cultivation of intellectual independence, for the pursuit of knowledge which seems to have no direct utilitarian application, we must look to those institutions which depend for their existence on private beneficence; that only here, free from the agitation and the tyranny of a democratic majority, can we hope that the pure light of learning will be kept burning. This line of criticism involves two assumptions, the mere statement of either one of which makes the whole position ridiculous. If the criticism be true, then it must be that the choice spirits are to be found at endowed universities only, that by some irresistible attraction they find their way to those institutions of learning to the loss of those which are supported by public money; or else it must be that the people, the democratic majority, refuse to have culture in their state institutions, an assumption which by no means is justified by historical facts or *a priori* theory.

In spite of all these criticisms, however, democracy is reaching out and taking possession of the field of higher education. "Those who believe that the practical instincts of men, as witnessed in a long stretch of history and over a broad area of political existence, do not easily go wholly wrong; and that in the case of a conflict of practical life with theoretical criticism the latter is most apt to be at fault, will be likely to demand a revision of theory" (Dewey). In view of this fact, I venture to put forward and to defend the thesis, not only that democracy is not incompatible with high scholarship in any line, but that, on the contrary, the cultivation of scholarship by democracy is necessary to its stability, progress and perpetuation. I assert that, using scholarship in a broad sense, the permanent interests of developed democracy demand that the pursuit of knowledge shall be made in its own interest, by its own servants, supported by itself, to the end that knowledge shall not be made to subserve the purposes of a class, but become the general property of the community for the promotion of its material, intellectual and spiritual well-being.

There is truth in the charge that scholarship has not developed in the United States, which may be regarded as a representative modern democracy. It is true that we are suffering now-a-days from an excess of materialism, from the arrogant assertions of positivistic science over imagination and spirituality; from the subjugation of idealism to realism, and from the too great importance attached to mere material prosperity. But it is not alone the greatest democracy of the world that is thus suffering, although perhaps it suffers more than others. The condition exists throughout the civilized world, and we hear protests against materialism from the apostles of the ideal in every country, whether monarchic, imperial or democratic. It is a passing phase of civilization. Civilization does not move forward equally in all directions at the same time. It develops first on this line, then in that direction, and later on still another plane. The great geographical and industrial discoveries of the past century have put emphasis upon material growth for the present, and the light of things spiritual seems low by contrast. But that light has not gone out. Mankind has seen similar conditions before, and now, as hitherto, they are but temporary.

For, in the first place, in the United States particularly, men have been obliged by the conditions attached to life in a new country to devote themselves to the pursuit of economic success. A nation, like an individual, can do only one great thing at a time. Our work during the first century of our existence was that of the conquest

of a continent. In the second place, democracy has not until lately joined itself with the educated classes for the promotion of scholarship, because it has distrusted scholars and scholarship for the reason that in the past they have been the allies of aristocracy. They have, in large measure, walked hand in hand with the oppressors of the people. The educated classes have chosen to identify themselves with the propertied classes rather than with the propertyless classes.

The truth is that most of the criticisms of democracy are founded on a misconception of its character and of its mode of declaring its will. Certainly, its most recent critics, like Mr. Lecky, Mr. Maine and Mr. Mallock, have confounded democracy with universal suffrage, which is a condition of democracy, but is not all of democracy; and then have misinterpreted the nature and effect of universal suffrage. "One of the great divisions of politics in our day," says Mr. Lecky, "is coming to be whether, as the last resort, the world should be governed by its ignorance or by its intelligence. According to the one party the preponderating power should be with education and property. According to the other the ultimate source of power, the supreme right of appeal and of control, belongs legitimately to the majority of the nation told by the head—or, in other words, to the poorest, the most ignorant, the most incapable, who are necessarily the most numerous." I deny that either experience or theory drives us to any such conclusion. I assert that universal suffrage does not make necessary the predominance of ignorance, nor democracy insistence upon intellectual equality. As Professor Giddings has truly put it: "It is not true that control by the ignorant implies the rule of ignorance." The expression of the will of a democratic people is the expression of a consensus of opinion. It is not simply the sum, or the difference between two sums, of single individual opinions each formed without reference to any other. The vote of a democratic people reflects a consensus of opinion and judgment originated and molded by their leaders. Hence, even if we should grant that democracy means the decision of matters by the mass of ignorant voters, it does not follow that their decision would be an ignorant decision.

Democracy may be either a form of government, or a form of the state, or a form of society. As a form of government it places direct control of all government matters in the hands of the whole body of voters, and no such government exists on a large scale. As a form of the state, democracy acts through representatives and its government is republican, like our own. As a form of society, democracy lodges ultimate power in all matters of societary character and interest in the hands of the whole body of the people. There is no need of a discussion of these differences here. For our present purpose we are concerned with democracy as a form of society and as a form of the state.

Democracy implies equality, but not necessarily equality of condition or status in all directions. It implies equality of civil and political rights. It may claim a closer approximation than we now have to social and economic equality. But it is not true, even in the United States, as De Tocqueville thought, that "the theory of equality is in fact applied to the intellect of man."

The observations of De Tocqueville were made at a time when democracy in this country was socially and economically homogeneous. At that time the economic condition of one citizen was approximately the same as that of another, and equality assumed the aspect of identity or sameness of condition in all respects. In a highly

developed or heterogeneous society, like our present, however, conditions are different. Here we find classes performing different services to the community and securing unequal rewards in proportion to the importance of their class functions. It is essential for the preservation of democracy, that under such conditions equality of opportunity to pass from one class to another shall remain absolutely open to all individuals. Great inequalities of material wealth are not incompatible with democratic government, or democratic society, but the pursuit of wealth as the principal object of the members of that society and its adoption as the criterion of personal success and worth, are a danger to democracy. It is necessary, therefore, to have tests of success and ideals of life, in addition to those of a mere economic character. Hence, we must have a variety of social classes in different important pursuits, success in each of which is as well thought of by the people and is as well rewarded by public applause as success in any other, and the opportunity to pursue any one of which is equally open to all. It is true, therefore, that in a democracy there is room for a class of scholars as well as for a class of carpenters. But it is not enough for my purpose to say that there is *a place* for scholarship in the democratic scheme. We must show the need for it and show that scholarship will supply the need.

Intellectual and spiritual inequality are established by nature, and no form of society can do away with them. Now the preservation of opportunity to secure equality of status in intellectual and spiritual matters, depends on the existence of an accessible class whose service is the promotion of scholarship and research and who are devoted to the service of the public. For, in the first place, the existence of this scholarly class and the promotion of scholarship will open up ever new lines of industrial opportunity and will therefore tend to prevent the permanent lodging of the power of wealth in any one group, since the poor man of to-day may be the rich man of to-morrow.

In the second place, and of far more importance, the promotion of scholarship and the existence of a scholarly class will furnish the true leaders of democracy. For the destiny of democracy will be determined, in the last analysis, by the character of the influential few who mold public opinion. The people demand and follow leaders. No race and no class can make progress without them. The opportunity for the talented to become leaders should be furnished, therefore, by a democratic society. The scholar is and should be the pioneer of such a society to discover new lands for democracy to possess; its frontiersman, to push forward the boundaries of its life, to enlarge the possibilities of its prosperity and happiness, to leaven its mass and create the conditions of a changing type of democratic citizenship. The pioneer discoveries of the scholar become in time the substance of the education and life of the democratic masses. As the problems of democracy become more numerous and complex the need for such leadership is more keenly felt. In its absence, caused in part by misunderstanding and distrust of those who are devoted to higher education, the people have turned to that curious and contemptible product called the "boss." But the boss can not always retain his leadership. He will retreat before the advance of intelligence. What is necessary is a proof that the scholar is a more honest and competent guide than the boss, and signs are not wanting that the public is learning to have more confidence in him. In short, if a democracy is to be stable, progressive and permanent, it must itself provide educational facilities which will maintain and

improve its material prosperity; educational facilities which will train men to uphold its political, ethical and intellectual ideals and to improve upon them by pushing forward the boundaries of knowledge by the discovery of new truth. It must train for its own leaders all who are capable of serving as such in any line of human activity or thought. This necessity involves the frank recognition of the fact that the doctrine of equality, which underlies democracy, can not be applied in the same sense in all directions. It means equality of status in civil and political matters, but not equality in economic condition, and, still less, in intellectual matters. Democracy will find its safety and growth only in a frank acceptance of the intellectual inequality of men, the selection of the superior as its leaders, and the provision of men and means to train these leaders as experts in its service in every line of its wants, including those whose special interest shall be the development and preservation of the intellectual and moral ideals and standards of the democracy. Unless it does this it will become the prey of the demagogue and of corrupt wealth.

But what kind of scholarship should a democracy support and in what ways can scholarship be shown to meet those needs of progress and leadership which I claim are necessary to the stability and permanence of a democratic society? By scholarship in this connection I mean not only the wide and deep knowledge of a particular subject, but the power to add new truth to the world's stock of knowledge which commonly goes under the name of research.

There is an idea not infrequently expressed that a publicly supported system of education, whether grade schools or universities, ought to be more concerned with those studies which are likely to contribute immediately or directly to earning a living than with those which have no immediate or direct connection with the acquisition of the material good things of life. I have already adverted to this thought, and I shall try in a moment to show that it is entirely without foundation, and that the continued success of a democracy not only permits but requires devotion to the pursuit of the most abstract sciences and the loftiest flights of imagination as well as to those more concrete subjects whose advance ministers to the immediate prosperity of an individual, a class or a community.

In considering this subject De Tocqueville roughly grouped all subjects of scientific pursuit into those which are theoretical, with no known application, those which are theoretical but whose study is carried on because the immediate application of the theory is obvious, and finally, the applied or so-called practical studies.

Of the three divisions into which we may group the lines of scholarly research the utility to democracy of what may be called practical scholarship and research is so obvious that we need not discuss it at length. This division of our subject comprises research in all those practical subjects which minister directly to the economic wants of the people. It comprises the whole group of applied sciences, including those engineering and agricultural subjects which have taken so prominent a place in our recent educational development. It is commendable and necessary to study how to make two blades of grass grow where one grew before, how to improve our soil so that the product of the acre shall continue to feed the growing multitude of the city and at the same time increase the profit of the farmer; how to harness the forces of nature to complicated machinery so that sufficient food and clothing shall be put within the reach of all. These things, I say, are desirable and neces-

sary, and it is natural that a new community with unaccumulated wealth should for a time devote all its energies to their accomplishment and promote the studies which accelerate them. No defense, therefore, is needed for the promotion of applied science at the public expense in a democratic community.

What shall we say, however, to justify the expenditure of public money to support people and supply means for inquiry into the abstract subjects of philosophy, mathematics, literature, history, psychology and similar studies, which, in the opinion of the masses and of most of the classes, are of "no use" and no direct utility to them? In the first place, we may say that there is no necessary conflict between such branches of study and the other group which we have just discussed. If there were, who would undertake to say which is the more important—subjects which promote the material welfare of the people or those which create and uplift their spiritual and intellectual ideals? There are times in the life of the nation when a Tyrtæus is needed as a leader more than a Cæsar. There are times when the enthusiasm for righteousness, the passion for truth, ebbs so low in the lives of individuals and nations that their welfare and progress, even in an economic sense, can be best promoted by arousing them to new enthusiasm and stirring them to new ideals. A democracy, therefore, is not compelled to choose between this kind of research and the other, as if it could not do both; as if, forsooth, it were compelled to choose which god it would serve. In the long run, applied science, theoretical science, and the abstract studies of a more speculative character must stand or fall together in the life of the people.

For, in the first place, as I have remarked, these lines of scholarship run into each other. "All experience proves that the spiritual is the first cause of the practical." In the eloquent words of Walter Bagehot, the "rise of physical science, the first great body of practical truth provable to all men, exemplifies this in the plainest way. If it had not been for quiet people who sat still and studied the sections of the cone, if other quiet people had not sat still and studied the theory of infinitesimals, or other quiet people had not sat still and worked out the doctrine of chances, the most dreamy moonshine as the purely practical mind would consider, of all human pursuits; if idle star gazers had not watched long and carefully the motions of the heavenly bodies, our modern astronomy would have been impossible, and without our astronomy our ships, our colonies, our seamen, all which makes modern life modern life, could not have existed. . . . It is the product of men whom their contemporaries thought dreamers, who . . . walked into a well from looking at the stars—who were believed to be useless to the world; who, to the practical mind, were mere theorizers, but without whose theories, of the study of which we sometimes grow so impatient, the practical results which we desire could not be reached."

Who could have foreseen that Franklin's experiment with the kite, with numberless other experiments that to the practical mind of the time seemed mere boy's play, would result in the vast modern practical development of electricity?

There are not many men in the ordinary walks of life who have ever heard the name of Willard Gibbs. Yet there is no name entitled to a more honorable place in the world of learning in the long list of those connected with Yale University since its foundation. He devoted his life to the study of an abstruse subject called vector analysis. In his application of this method of mathematical investigation to the study of the relations between heat and

the energy of chemical combination he contributed, in the words of Professor Ostwald, "untouched treasures in the greatest abundance, and of the greatest importance for the theoretical and experimental investigator, and revolutionized in some of its branches the theories of chemical science."

Last fall one of the professors of this university by chance read in French a folk lore story which, after some research, he found was common to the Scandinavian, the German, the Hebrew, and probably other, peoples. As a result of his investigation he read an important paper last December at the meeting of the Modern Language Association in Columbus, Ohio, trying to show that this story and the spiritual or ethical precepts underlying it were the common property of many nations. Was his time wasted? Can such an inquiry be of any use to the people of a democracy? I answer yes. It is of use for its own sake, because it reaches down and stirs again into activity the elemental feelings common to all nations, and leads them to think of the unity of the race and the oneness, if I may say so, of its basic, moral and intellectual ideas. It is defensible, too, on a lower, or utilitarian, ground. I can conceive of the use of the facts brought out by this investigation as a help in promoting the assimilation of the foreign elements of our population. One fact concerning our immigration, which more than any other stands in the way of rapid assimilation, is the feeling of separateness or alienation among thousands of the foreigners who are now coming to our shores. The Slav, the Magyar, the Italian, the Russian, the Jew, feels that there is nothing common to him and this new American life into the midst of whose hurly-burly he is thrust. The telling of a story which is the common property of many races, to a group of such foreigners, gives them a certain community of feeling and interest, helps to break down their feeling of separateness, and shows them that the distance between the emotional and intellectual nature of themselves and the native American is after all not so great. This is one of the keys to success in some social-settlement work.

The other day we laid at rest, with such poor honors as we could show, one of the gentlest spirits and most enthusiastic scholars of our group. Gustav Karsten had a passion for research in his chosen field. Although from my conversations with him I judge that he had no thought that his work was capable of any possible practical application, yet who shall say that in time to come his study of philology and his researches into the elements common to many languages and his study of phonetics, may not aid in producing a language that shall be the common property of the commercial world and promote that very practical life from which his subject of study was so far removed? It is not a new thing in experience for philological and historical research to produce political and practical, as well as scientific and literary, results.

But the study of abstract subjects has another defense than is found in the fact that they may unexpectedly contribute to the practical. Even a democracy has classes with spiritual and intellectual aspirations, and such studies tend to produce results that satisfy the desires and better the lives of some classes, at any rate, in the community. Now a democracy may not insist that public money spent on education shall be restricted to the kind of education that will benefit one class only. Every class in the community has a right to ask that its interests, the subjects to which its heart and mind turn, shall receive their due attention. To justify the promotion of scholarly study in cultural

subjects, it is enough, therefore, to show that in a democracy there is a class whose happiness is promoted by such studies.

But we may place our argument on yet higher ground. The defense of the maintenance of scholarship in abstract and purely theoretical subjects rests not merely on the possibility that they will help us to more or better economic opportunities, or that they will satisfy the cultural demands of a class. Their strongest defense lies in the fact that a democracy needs to develop scholarship pure and simple, in the abstract—philology, art, philosophy, history, literature—in order to subserve wants that can not be satisfied by any other kind of knowledge. The satisfaction of the higher wants of a democratic people is necessary to prevent the decay of democracy. If any evidence of this were needed we see it all about us as a result of the too exclusive attention that we have thus far given to merely economic or material development. The present evils of our body social and politic are largely due to our over-emphasis of wealth, and the undue honor we have attached to the class that has supplied our economic wants.

Carlyle expressed a great truth when he said that the people would have leaders. Democracy needs ideals and leaders to sustain itself. Few people do their own thinking. Most inherit or borrow their beliefs. In the past the masses have taken their ideals and leaders from the class whose interests were not at one with their own or not primarily devoted to them. Democracy must train its own leaders, set up its own standards, establish its own ideals. The true life of a people is intellectual and spiritual. Material prosperity is a means, not an end. No democracy can endure which rests content with material prosperity. It must have as its ideals, intelligence, honesty, honor, service, all that makes character for an individual; liberty, fraternity and equality of opportunity, for public life. It can get and keep these ideals only if it provides means to men to gather for it the world's knowledge, to add to this knowledge, to set standards of public opinion and to stir the moral and spiritual nature of the people. We should have less occasion to-day for the denunciation of iniquitous wealth and we should see less of the betrayal of honor and trust in high places, if we had laid more emphasis in the last generation upon the necessity of knowledge in leaders of our people. We should have a better political and social policy if we had trusted more in the leadership of men who know the race life, its changing ideals, its history, its experiences, and its impulses. In the absence of such leaders the people, in their desire to be led, have turned, as they always will do, to the nearest demagogue who professes to be appointed to "prepare the way of the Lord."

What means now are appropriate for training such leaders and for setting up such standards of democratic life? I answer research, scholarship, in history, literature, philosophy and art—the records of human experience, the interpretation of human life, the analysis of human motives—to supply inspiration and formulate ideals that may be woven into the life of the people and become the intellectual and spiritual inheritance of the nation; to frame and furnish the ideas and impulses that shall be the substance of the common consciousness and find expression as the consensus of public opinion through political action in the formulation of law, creed and the general social order.

The nineteenth century was one of great material development whose activity has hardly yet slackened. If democracy is to endure, or is not to sink into a materialism like communism, the twentieth century must develop our legal, political, social and

ethical ideals and institutions to a corresponding degree. In the absence of such development the only alternatives are the worship of materialism leading to the communistic or socialistic order, or the destruction of democracy by the propertied classes, who will not permit communism. For the prevention of either disaster the promotion of scholarship in every subject of study will help.

If any evidence were needed that democracy requires ideals and scholarly leaders we shall find it in the evils that we are suffering from in our present conditions. We are concerned with the necessity of solving certain great problems. The problem of poverty which is ever with us is crying constantly for a scientific and ethical solution. The problem of city government is one the treatment of which has made our democratic people the laughing stock of the world and has done more to discredit democracy and raise doubts about its future success and permanence than almost any other of its failures. The great problem of immigration with its necessity of assimilation of our foreign population and the consequent problems of the modification of our forms of government to adapt them to the spirit and race conditions of a new people, is looming large in the immediate future. The adjustment of class relations, our relations to the people across the sea whom we have recently tied to ourselves, the negro problem, the currency problem, the problem of taxation, whose present condition in almost every state in the union is a disgrace to the intelligence of the people—all of these are pressing on us for solution, and upon our success in solving them will depend the continuance of our republican institutions. To whom shall the people look for guidance? To the ward heeler and the boss? To the man in the street, as we have been doing, who wins a following by his glib eloquence? Or shall we turn to the men who have studied deeply into the history and the experience of other peoples in the lines in which these problems run? It is to the philosopher, the student of literature, the student of the social sciences, aye, to the poet and the artist as well as to the man with a sense of practical administration, to whom we must turn for proper ideals and correct principles, on which to solve these problems and handle these difficulties.

There are, indeed, some signs of a change from our practise of following ignorant bosses. We have put our federal bureau of corporations, our census bureau, many of the divisions of our department of agriculture and some other branches of our government service directly in charge of those who are scholars in their respective fields. One of the most prominent, if not the principal figure, of the American delegation at the recent Peace Conference was one of our group, known and honored for his scholarship in the subject of international law. It has been said recently that "no governor of a commonwealth can permanently command public confidence except he add to political shrewdness the gift of political idealism." And there is other evidence that "our country still aspires to be led by men who shall prove their claim for leadership not by concrete material achievements, but by their character and their ideals."

Thus, then, is the future progress and welfare and permanence of democracy bound up with its promotion of scholarship and research; the promotion of technical research for its material welfare; the promotion of research in the theoretical and abstract sciences and in the humanities, to furnish ideals and leaders, to satisfy its intellectual and spiritual needs. Democracy, if it thus supplies its own need for leadership, will not die. The equalization

of power is destined to spread further than it has, in industry and government—in every direction. It will be better balanced because it will depend more on natural and trained leadership. In the past the masses have depended for leaders on the capable few whose interests were aristocratic, because they had no other choice; and the present distrust of scholarship is simply, in part at least, a revulsion from this coercion. They will depend again on a chosen scholarly few, and because they choose to do so they will provide for and command and control their services in the interests of all. They will create a scholarly class devoted to the service of the people, supported by the people, and entrance to which is free to all who have natural talent and the capacity. The masses will recognize more and more that while seeking greater equality in civil and political rights, in legal status, in industrial opportunity and condition, the natural inequality based on differences of capacity, ability and talent can never be eradicated; that, therefore, they must be utilized in the service of the people. That to be devoted to the service of the people they must be supported by the people and must be looked to as the source of supply of the ideals and the leadership needed to keep active the intellectual and spiritual life necessary to the permanence of democratic institutions.

We must not shut our eyes to the fact that scholarship supported by a democracy is subjected to some peculiar dangers. In the first place, the scholar can not command results, and there is danger that the impatience of the public for results will imperil the prolonged support necessary for the quiet meditation without which scholarship can not flourish at all. This danger can be met only by educating the public, and there are signs that the educative process has begun.

In the second place, scholarship supported by democracy is subjected to danger to liberty of thought and opinion—a danger to which the minority is always exposed from the tyranny of the majority. There is danger always that unpopular truth will be rejected and its advocates persecuted. True, there are some who believe that that danger is passing away. I do not share their belief. I see no signs that the tyranny of popular opinion is any less to-day than it ever was, or that there is likely to be greater liberty of opinion in the future than in the past. It is true, still, as it always has been, of all those who are in advance of their times and who hold the lamp of spiritual and intellectual truth aloft for the guidance of the people that

> The age in which they live
> Will not forgive
> The splendour of the everlasting light
> That makes their foreheads bright,
> Nor the sublime forerunning of their time.

There is no means of removing this danger, although, fortunately, "in the development of the policy of the great labor organizations, there are signs that the wage earners are learning the truth that liberty is the mother of progress." It is questionable, however, whether it is a more serious danger than befalls a scholarship supported by an aristocracy. There is as much danger that in the latter case truth will be colored to meet the ideas of the supporters of the scholars and their work, as that in the latter case it will be colored to curry popular favor. The duty of the scholar is plain—he must be the servant, not the slave, of democracy. He must have the courage of the seeker after truth. He must be ready, if necessary, to be a martyr to public opinion for the sake of the truth he finds. The scholar must see to it, too, that he does not yield to popular clamor and emasculate education by popularizing learning. He must ever "insist that

studies which can never by any possibility be popular, or appeal even to any large number of students, but which have demonstrated their power to enlighten and to ennoble those who pursue them, shall not be given up in obedience to popular clamor, merely to make way for other things that seem to be of more immediate utility." Consequently, we must put in the curriculum of our graduate schools those subjects whose study best disciplines the mind and character, makes strong men, establishes high ideals; subjects the most abstract and far removed from the material needs of mankind, even though popular clamor in its mistaken zeal is against them.

The state of Illinois has taken a noteworthy step in the history of democratic government in appropriating money specifically for the support of a graduate school of the arts and sciences. It is evidence that the democratic people of Illinois believe that scholarship is necessary to progress, prosperity and the continuance of democratic ideals. Their act is evidence of the existence of at least a subconscious belief that only thus can the democratic institutions that have become endeared to us be made permanent. The public of this state has learned more rapidly, and in a way that the people of scarcely any other state has learned, the value of research in the arts and sciences, from the splendid success and service of applied science, particularly in agriculture and engineering. They are carrying the lesson over and showing that they believe that the satisfaction of the intellectual and moral needs of the masses is as important a matter for public support as their material prosperity, or economic progress. It is therefore a high trust that is committed to us. We are called on here to lay plans which will bear fruit in the enrichment of the spiritual and intellectual nature and life of the people of our state and country. We are called on to add to the sum of the world's knowledge in the name of and through the support of a democratic people, to the end that the world shall be a better world, that democracy in particular shall be able to follow truer ideals and reach a higher life than it can without such scholarship. We are called on to make the State University the center of knowledge and information for all matters relating to public life and private welfare, in the interest of the citizens, and to furnish them the means for their intellectual, ethical and spiritual growth.

DAVID KINLEY

UNIVERSITY OF ILLINOIS

PROFESSOR WHITMAN AND THE MARINE BIOLOGICAL LABORATORY

PROFESSOR WHITMAN'S services to biology as director of the Marine Biological Laboratory have been so notable and his retirement from that post is a matter of so much general interest that consent has been obtained to publish the following abstract from the minutes of the trustees of the laboratory:

UNIVERSITY OF CHICAGO

August 8, 1908.

TO THE TRUSTEES OF THE MARINE BIOLOGICAL LABORATORY, WOODS HOLL, MASS.

Gentlemen: This year has brought the twenty-first birthday of the Marine Biological Laboratory. For these many years you have continued to honor me with the directorship of the laboratory. In late years I have so far drifted out of office and out of use that a formal resignation at this time can be scarcely more than an announcement of the fact accomplished. The time has arrived, however, when a reorganization seems to be imperatively demanded, and as a prelude thereto, I must ask you to accept this note as a somewhat belated announcement of my resignation of the office of director.

Let me take this opportunity to thank you one and all very heartily for the cordial support you have extended to me.

Respectfully,

C. O. WHITMAN

MARINE BIOLOGICAL LABORATORY
WOODS HOLL, MASS.,
August 13, 1908.

The corporation and trustees of the Marine Biological Laboratory, in accepting the resignation of the director, Professor C. O. Whitman, have ordered to be put upon their records and to be forwarded to Dr. Whitman the following minute:

The corporation and trustees desire to express to the retiring director their regret that he finds it necessary to withdraw from the active directorship of the laboratory and their appreciation of the inestimable value of his services. Since the establishment of the laboratory at Woods Hole, twenty-one years ago, he has been continuously its director and he has to a very large extent guided its growth and development. He has stood for the principles of cooperation and independence which have made the laboratory unique in its character and truly national in its influence. His high ideals and his generous appreciation of the work of others have been an inspiration to the many biologists who, during these years, have attended the laboratory. These ideals are the most valuable possession of the laboratory.

The corporation and trustees desire that the retiring director may continue to serve the laboratory as honorary director and trustee and that in the future as in the past his presence at the laboratory may continue to be an inspiration.

UNIVERSITY OF CHICAGO
August 17, 1908.

TO THE CORPORATION AND TRUSTEES OF THE MARINE BIOLOGICAL LABORATORY, WOODS HOLL, MASS.

Ladies and Gentlemen: Your action of August 13, in which you express a desire to have me serve the laboratory as "honorary director and trustee" is, in itself alone, an all-sufficient reward for whatever service I have rendered as director. Your *good will* is the all-important recompense, and no title that you could confer could add to the weight of your approbation. In fact, titles belittle the spirit. Let me have the latter without the former—without title or office of any kind. Please respect this wish and believe me, as ever, a sincere and devoted friend of the laboratory.

Respectfully and cordially,
C. O. WHITMAN

SCIENTIFIC NOTES AND NEWS

IT is announced that the Berlin Academy of Sciences has received a legacy of 30,000,000 Marks (about $7,500,000), being the entire fortune of a millionaire named Samson, a Berlin banker, who recently died childless at Brussels.

THE National Academy of Sciences will hold its autumn meeting in the physical laboratory of the Johns Hopkins University, Baltimore, beginning on the morning of Tuesday, November 17.

THE navy department has received a letter from Commander Peary, dated from the *Roosevelt* on August 17, announcing his safe arrival at Etah, North Greenland. The trip so far had been satisfactory, and he expected to proceed north on that night.

DR. ALBRECHT PENCK, professor of geography at Berlin, arrived in New York on Saturday, and has this week begun his duties as Kaiser Wilhelm professor at Columbia University and Silliman lecturer at Yale University.

PROFESSOR RUSSELL H. CHITTENDEN, director of the Sheffield Scientific School of Yale University, has been appointed the university's representative at the Darwin celebration to be held at the University of Cambridge next June.

DR. S. H. BABCOCK, of the University of Wisconsin, has been presented with a silver medal by the European DeLaval Separator Corporation of Stockholm, Sweden, in recognition of the distinguished service which he has rendered to the advancement of dairying. The medal, which was issued on the occasion of the twenty-fifth anniversary of the corporation, bears on one side the busts of Dr. Gustaf DeLaval, the inventor of the separator, and Sir John Bernstrom, originator of important improvements, and, on the reverse, figures of the genius of invention handing the separator to Mercury, the god of commerce, to be carried around the world.

DR. A. TINGLE, B.Sc. (London and Aberdeen), Ph.D. (Pennsylvania), has been appointed scientific adviser to the viceroy of the Province of Chili, China. Dr. Tingle's address is care of No. 5 Post Office, Ho Pei, Tientsin City, China.

THE district foresters who will be in charge of the six field districts of the Forest Service, beginning on January 1, 1909, have been selected by United States Forester Gifford Pinchot. They are as follows: District 1, W. B. Greeley, Missoula, Montana; District 2, Smith Riley, Denver, Colorado; District 3, A. C. Ringland, Albuquerque, New Mexico; District 4, Clyde Leavitt, Ogden, Utah; District 5, F. E. Olmsted, San Francisco, California; District 6, E. T. Allen, Portland, Oregon.

PROFESSOR HARRY GIDEON WELLS, dean of the Medical Department of the University of Chicago, will spend the fall in some special study and investigation at the Sheffield Physiological Laboratory, Yale University.

F. W. FOXWORTHY, who is connected with government scientific work in the Philippine Islands, has during the past summer been engaged in the study of the trees in Sarawak and the Federated Malay States. He intends to return for a visit to the United States in the near future.

DR. E. R. DOWNING, of the Northern State Normal School, who has been studying the past year in the biological laboratories of Europe, has returned and may be addressed again at Marquette, Michigan.

R. B. GRIEG, lecturer on agriculture at Marischal College, Aberdeen, and R. P. Wright, principal of the West of Scotland Agricultural College, at Glasgow, have been visiting the leading American agricultural colleges, with view to securing information to be used in improving agricultural education in Scotland.

THE College of Arts and Sciences of the University of Maine announces for the fall semester a series of lectures on the history of science. Dean Hart will lecture on the history of mathematics, Dean Stevens on the history of physics, Professor Aubert on the history of chemistry, Professor Merrill on the history of biological chemistry, Professor Drew on the history of zoology, and Professor Chrysler on the history of botany.

DR. DANIEL COIT GILMAN, professor of geography at Yale University from 1863 to 1872, president of the University of California from 1872 to 1875, first president of the Johns Hopkins University from 1875 to 1901, first president of the Carnegie Institution from 1902 to 1904, eminent for his services to higher education, died suddenly on October 14, at Norwich, Conn., where he was born on July 6, 1831.

THE deaths are announced of Dr. Alexander Korkin, professor of mathematics at St. Petersburg, at the age of seventy-one years; of Dr. Alexis Hansky, associate astronomer in the Pulkowa Observatory, at the age of thirty-eight years, and of M. D. Clos, director of the Botanical Garden at Toulouse.

UNITED STATES civil service examinations are announced as follows: On November 5, for biological chemist in the Bureau of Chemistry in the Department of Agriculture, at a salary of $1,200; on November 9, for chief of the cattle and grain investigation laboratory in the same bureau at a salary of $2,500, and for assistant in agricultural education in the Office of Experiment Stations, at a salary of from $1,400 to $1,800.

IN the belief that our knowledge of comets may be considerably enlarged through a proper use of the opportunities presented by the approaching return of Halley's comet and the systematic observation of such other cometary phenomena as may be presented during the next few years, the Astronomical and Astrophysical Society of America has appointed a committee upon comets, consisting of Professors George C. Comstock, chairman, Edward E. Barnard, Charles D. Perrine and Edward C. Pickering. It is the purpose of this committee to canvass the whole field of cometary research, inquiring what parts of that field will best repay systematic cultivation at the present time and securing, so far as possible, cooperation in such research.

AT the Johns Hopkins University two acres of ground at the new site have been devoted to a botanical garden. On this plot a greenhouse, 80 feet long, and a laboratory for plant physiology have been erected. An acre and a quarter of land has been laid out in four formal squares bounded by hemlock hedges. Within these squares are beds and pools which have been planted with some three hundred types illustrating the adaptation of vegeta-

tive organs of plants, the structure and cross-pollination of flowers and the dispersal of fruits and seeds. Next season other squares will be planted with a collection of economic plants. The greenhouse and laboratory are completed and will be occupied during the year by students doing research or laboratory work in plant physiology.

It is stated in *Nature* that to mark the completion of the fiftieth year of the existence of the Geologists' Association, it is proposed to issue a volume dealing with the geology of the districts of England and Wales visited by the association since its foundation. The work, which will be edited by Messrs. H. W. Monckton and R. S. Herries, will be illustrated by maps and sections, and be ready for publication, it is hoped, before the end of the present year. Orders for copies should be sent to the secretary of the association.

The annual meeting of the New England Geological Excursion will be on Long Island on October 24 to study the terminal moraine and other glacial and geological features. The party will start from New Haven, where arrangements for the transportation of the party will be made by the Yale geological faculty. Details concerning the itinerary, expenses, leaders, etc., will be sent to members of the organization in a few days. Geologists, not members, are invited and may obtain information by writing to the secretary, Professor H. F. Cleland, Williams College, Williamstown, Mass.

We learn from the *British Medical Journal* that Sir David Bruce, who was director of the Royal Society's commission in 1903, has left England on his second visit to Uganda, where he will continue his investigation as to the pathology of sleeping sickness. The expedition has been organized at the request of the Colonial Office, and the treasury is finding the necessary funds. Sir David Bruce will be accompanied by two other officers of the Royal Army Medical Corps, Captain H. R. Bateman and Captain A. E. Hamerton. Lady Bruce, who has accompanied her husband on similar missions in Uganda, Zululand and Malta, is a member of the new commission, and will take an active part in the investigations. The headquarters of the work will be selected two miles from the lake shore in a wild and depopulated region in the province of Chagwe. There the Uganda government has been preparing a laboratory and station for the purposes of the mission. It is expected that the work of the commission will occupy about nine months.

The twenty-ninth free lecture course of the Field Museum of Natural History will be given on Saturday afternoons at three o'clock, as follows:

October 3—"Through the Cataracts of the Nile," by Professor James H. Breasted, the University of Chicago.

October 10—"A Naturalist in Venezuela," by Dr. N. Dearborn, assistant curator of ornithology, Field Museum of Natural History.

October 17—"The Great American Deserts as seen in New Mexico and Sonora," by Professor Thomas H. Macbride, the State University of Iowa.

October 24—"The Geology and Scenery of the Pipestone Region," by Professor Samuel Calvin, the State University of Iowa.

October 31—"Among the Birds in Costa Rica and Panama," by Mr. J. F. Perry, assistant, division of ornithology, Field Museum of Natural History.

November 7—"Life of a Lake in Summer," by Dr. Edward A. Birge, University of Wisconsin.

November 14—"The Heraldry of the Indians," by Mr. James Mooney, United States Bureau of Ethnology.

November 21—"The Glaciers of the St. Elias Region, Alaska," by Professor R. S. Tarr, Cornell University.

November 28—"Holland," by Professor James Howard Gore, the George Washington University.

We learn from *Nature* that an International Rubber Exhibition was opened in London on September 14. The exhibits consisted wholly of objects of interest to members of the rubber and allied trades, and comprised illustrations of the growth of the commodity and examples of the machinery employed in its manipulation. Rubber trees in all stages of their growth were shown, together with the raw material obtained from them, and the varied forms into which it is manufactured. Demonstrations were given in a laboratory, and

growers, manufacturers and others had an opportunity of discussing questions relating to the industry at an international congress, to which delegates were sent by many continental countries. Borneo, Mexico and other rubber-producing countries took part in the enterprise.

THE National Conservation Commission has caused the first comprehensive attempt at a census of the standing timber in the United States ever undertaken. The Forest Service has for several years been eager to take such a census, and the Bureau of the Census has expressed its willingness to cooperate, but funds have never been available. The conservation commission, however, needs the information to help complete its inventory of the country's natural resources, which it will include in its report to the president, and since that report is to be submitted on the first of next year, it needs the information at once. Large portions of the forests of the country, including practically all the national forests, have been estimated at various times, but these figures have never been brought together and no organized effort has ever been made to gather them into one total, nor to supply the deficiencies where hitherto no estimates have been made. As a result, the guesses as to the amount of standing timber in the United States, range from 822,682 million to 2,000 billion board feet. In the opinion of the Forest Service, the most carefully prepared estimates yet made are those by Henry Gannett, published by the Twelfth Census in 1900. These placed the total stumpage at 1,390 billion board feet. Mr. Gannett has been chosen by the president to compile the information gathered for the commission, and with his previous acquaintance with the subject of forestry, he is at work now enlarging the knowledge of forest areas at present available. The importance of this census lies largely in the fact that it will give an accurate basis for computing how long our timber supplies will last. Through the cooperation of the Forest Service and the Census Bureau the country's annual consumption of wood is known with tolerable accuracy, although even here there are some discrepancies, because a large amount of wood is used for posts, fuel and domestic purposes, for which no satisfactory data have yet been collected. But the consensus of opinion is that the present annual consumption is about 100 billion board feet, or something more than that. One leading authority has placed it as high as 150 billion board feet. Assuming a stumpage of 1,400 billion feet, an annual use of 100 billion feet, and neglecting growth in the calculation, the exhaustion of our timber supply is indicated in fourteen years. Assuming the same use and stand, with an annual growth of 40 billion feet, we have a supply for twenty-three years. Assuming an annual use of 150 billion feet, the first supposition becomes nine years, and the second thirteen years. Assuming a stand of 2,000 billion feet, a use of 100 billion feet, and neglecting growth, we have twenty years' supply. Assuming the same conditions, with an annual growth of 40 billion feet, we have thirty-three years' supply. With an annual use of 150 billion feet, these estimates become, respectively, thirteen and eighteen years.

ACCIDENTS in the coal mines of the United States in 1907 resulted in death to 3,125 men and injury to 5,316 more—an increase of 1,033 in the number of deaths and 516 in the number of injuries over the record for 1906. This record marks the year, in all other respects the most prosperous, as one of the worst in the history of the coal-mining industry of the country. Even the above figures, however, fail to represent the full extent of the disasters, for any statistical statement that attempts to cover coal-mining accidents for the entire United States is necessarily somewhat incomplete. The U. S. Geological Survey, by which the figures for the country are published, does not collect the information directly, but obtains it through the courtesy of state or territory mine inspectors or other officials who compile data concerning accidents and their causes and effects. A number of the coal-producing states have no officials charged with these duties, and one or two of the state officials failed to reply to the inquiries sent out by the survey. In 1906 returns were received from 21 states and ter-

ritories; in 1907 only 18 reported. The reports received indicate a death rate per thousand employees of 3.31 in 1906 and 4.86 in 1907, and the number of tons mined for each life lost decreased from 194,950 to 145,471. The state which had the lowest death rate per thousand (0.95) in 1907 was Missouri, where 499,742 tons of coal were mined for each life lost. Michigan was second on the roll of honor as far as death rate per thousand employees was concerned, and Kentucky was second in the number of tons mined for each life lost. The death rate in Michigan was 1.76 per thousand; in Kentucky it was 1.89. Kentucky mined 336,035 tons of coal for each life lost; Michigan mined 290,837 tons. Arkansas reported a death rate of 1.97 in 1907, with 133,522 tons mined for each life lost, and Utah, with a death rate of 2.72, mined 324,601 tons for each life lost. West Virginia reported the largest death rate in 1907—12.35 per thousand—and the lowest production for each life lost—65,969 tons. New Mexico stood next to West Virginia, with a death rate of 11.45 and a production of 77,322 tons for each life lost, and Alabama was next, with a death rate of 7.2 per thousand and a production of 92,535 tons for each life lost.

Nature states that silver medals are this year offered by the Industrial Society of Mulhouse for the synthesis of a gum possessing the properties of Senegal gum, and for a handbook treating of the drugs used in the dyeing and printing industries; a medal of honor is offered for an economical substitute for dried egg-albumen, or for a decolorized blood-albumen for the same purpose. Other awards will be given for papers on the coloring matter or on the carmine in cochineal; the theory and manufacture of alizarin reds; the composition of aniline black; the transformation of cotton into oxycellulose; the composition of coloring matter and synthesis of a natural color, various mordants, bleaching processes and colors, etc. Papers, etc., must reach the Président de la Société Industrielle de Mulhouse, Alsace-Lorraine, before February 15, 1909.

The smelter production of copper in the United States in 1907, according to L. C. Graton, of the United States Geological Survey, was 868,996,491 pounds. From the record figures of 1906 this is a decrease of 48,809,191 pounds, or 5.6 per cent., the largest actual decrease ever recorded and the largest relative decrease since the American copper industry became important. This is the first time since 1901 that the annual production has been smaller than that of the preceding year, and the first time since 1872 that it has been smaller than that of the second year preceding. The total given above is made up of the fine copper content of blister produced and of the smelter output of ingot and anode copper from Michigan. Of this quantity, approximately 10,075,048 pounds in blister were produced in foreign smelters from domestic materials exported. In addition to the domestic materials handled, smelters in this country turned out as blister 64,145,648 pounds from foreign ore, concentrates, and matte. Domestic blister containing 42,350,963 pounds was exported unrefined, while blister from foreign sources containing approximately 183,530,132 pounds fine copper was imported for refining in this country. The greatest decreases in smelter output are shown by the returns from the three states that rank highest. Montana's production, which was 294,701,252 pounds in 1906, was but 224,263,789 pounds in 1907, and the state yielded first place to its rival, Arizona, whose production, however, showed a decrease of nearly 6,000,000 pounds, from 262,566,103 pounds in 1906 to 256,778,437 pounds in 1907. Michigan still holds third place, with its production decreased from 229,695,730 pounds in 1906 to 219,131,503 pounds in 1907. Decreased production is also shown by the returns from Alaska, Oregon, Washington and North Carolina. Many of the other copper-producing states showed substantial gains. The output of Utah, the fourth state in point of production, was nearly 16,000,000 pounds in excess of that of 1906—66,418,370 pounds in 1907 as against 50,329,119 pounds in the preceding year. The production of California increased from 28,153,202 pounds in 1906 to 33,696,602 pounds in 1907; that of Colorado

from 7,427,253 pounds in 1906 to 13,998,496 pounds in 1907; that of New Mexico from 7,099,842 pounds in 1906 to 10,140,140 pounds in 1907, and that of Idaho from 8,578,046 pounds in 1906 to 9,707,299 pounds in 1907. Nevada and Vermont also showed productive gains.

A NOTE in the London *Times* says that the fine herd of Indian cattle presented to the London Zoological Society by the president, the Duke of Bedford, has been a considerable attraction, and now that two of the cows—of the Mysore and Hissar breeds—have produced calves, the interest of visitors in these animals has increased. In the same house is a black calf of the Chartley × Vaynol blood, two abnormally colored calves having been thrown in succession by the same cow. A serow born in the garden proved to be an example of the Sumatran species (*Capricornis sumatrensis*), but, unfortunately, it lived only a few days in the menagerie. The other, which has been in the collection for more than two years, is in excellent condition; so far as can be ascertained, it is the first to reach England. For some little time the waders' aviary has been under repair; the birds have been removed to the covered-in paddocks in front of the anthropoid house, but will probably be brought back in the course of a few days. The curassow chicks hatched out in the northern pheasantry are doing very well, and now mount up on the high perches. The practise of feeding the young was continued by the mother for more than a fortnight. In the aviaries in the new bird house is the finest collection of birds of paradise ever brought together. The last importation was effected by the society in conjunction with Sir William Ingram, by whom Mr. Horsbrugh was sent out to New Guinea. News has been received that the collector now working there for Sir William Ingram has obtained a great prize—a fine male of Prince Rudolph's bird of paradise (*Paradisornis rudolphi*), first obtained by Hunstein and described by Finsch and Meyer in 1885. In this species the side-plumes, of which there are two on each side, are blue, which is the dominant note of the plumage. The type-specimen is in the Dresden Museum, and when Dr. Bowdler Sharpe wrote his monograph on the birds of paradise there was no skin of a male in the national collection in Cromwell-road.

UNIVERSITY AND EDUCATIONAL NEWS

THE annual report of the treasurer of Yale University for the fiscal year ending June 30, 1908, shows additions to the funds during the year of $1,263,444. The principal items are $63,149 from the Yale Alumni fund; from the Archibald Henry Blount bequest, $337,291; from the Lura Currier bequest, $100,000; by bequest of D. Willis James, $95,250; from contributions to the university endowment and extension fund, $335,665; and from balance of the Ross library fund, $112,220. From the Blount bequest $242,903 has been used to repay advances made by alumni to secure the Hillhouse property. Gifts to income amounted to $76,494, of which $30,000 came from the Alumni Fund Association. The following table is given showing the cost and receipts per student in the different departments:

Department	Students in Attendance	Average Cost per Student	Average Receipts per Student	Percentage of Receipts to Expenses
Graduate	357	$159.45	$ 40.17	25.2
Academical	1,315	339.56	152.27	44.8
Sheffield Scientific	948	279.66	160.25	57.3
Theological	80	641.03	.....	...
Law	339	177.14	122.86	69.3
Medical	137	396.90	130.22	32.9
Art	39	315.02	69.25	21.9
Music	83	268.99	140.12	52.1
Forestry	61	469.39	119.17	25.3
All departments..	3,359	$296.85	$133.25	44.9

GOVERNOR G. W. DONOGHY, of Arkansas, President John Tillman, of the State University, and George B. Cook, state superintendent of education, have been visiting representative institutions of higher education in the middle west to gather information with a view to recommending an appropriation of $500,000 for the extension and improvement of the State University of Arkansas.

THE zoology department of the University of Kansas has received a large consignment of marine biological specimens collected during

the summer on the gulf coast in Texas under direction of Professor C. E. McClung. This material will be used in the biological classes of the university and will also be furnished at cost to zoology classes in the accredited high schools of the state.

The registration at the close of the first week at the University of Wisconsin shows an increase of 331 students over the number enrolled at the same time last year. This gain indicates that the total number of students at the university this year will be over 4,500.

The new building of the engineering laboratory of the Heriot-Watt College, Edinburgh, was opened by the Earl of Rosebery on September 16.

The Russian minister of public instruction has forbidden women to attend university lectures in the future, but permits those to complete their studies at universities who have already received permission, and whose transfer to higher educational institutions for women is impossible.

At Wesleyan University (not Northwestern University, as previously stated) David R. Whitney, of Columbia University, has been appointed instructor in biology, and J. W. Turrentine, M.Sc. (North Carolina), Ph.D. (Cornell), instructor in physical chemistry.

Dr. Harry T. Marshall has returned from Manila and has assumed charge of the work in pathology and bacteriology at the University of Virginia. He is assisted by Dr. Carl Meloy, who returns to the university this year as adjunct professor of pathology.

The following appointments have been announced in the Sheffield Scientific School of Yale University: Arthur Lyman Dean, Ph.D., to be instructor in industrial chemistry; J. F. McClelland, M.E., to be lecturer on mining engineering, and William Harry Kirkham to be instructor in biology. In the Medical School Dr. Marvin Scarborough, M.A., has been appointed instructor in pharmacology.

At the College of the City of New York the following have been promoted from the grade of tutor to that of instructor: In chemistry, Robert W. Curtis, Ph.D. (Yale); William L. Prager, Ph.D. (Clark); Reston Stevenson, Ph.D. (Columbia); in descriptive geometry and drawing, William Chadwick and Frederick W. Hutchison; in education, Samuel B. Heckman, Ph.D. (Pennsylvania); in philosophy, Howard D. Marsh, Ph.D. (Columbia); in physics, David H. Ray, Sc.D. (New York University). Dr. W. L. Estabrooke has been appointed a tutor in the department of chemistry.

At George Washington University Mr. Sidney I. Kornhauser has been appointed instructor in biology and Dr. Irving K. Phelps, instructor in physiology.

Mr. James P. Barrett has resigned an assistantship in botany at Illinois Agricultural Station to accept a fellowship in botany at Cornell University.

The board of governors of the University of Toronto in July last established, at the urgent request of Professor A. B. Macallum, the head of the department of physiology and physiological chemistry, a second professorship in the department and on September 24 the board appointed Professor T. G. Brodie, M.D., F.R.S., of the Royal Veterinary College, London, to the position as titular professor of physiology. Professor Brodie has accepted the appointment and will assume his duties at Toronto in November.

DISCUSSION AND CORRESPONDENCE

AN UNUSUAL METEORIC FALL

To the Editor of Science: There was an unusual and somewhat remarkable fall of meteoric masses in this vicinity on the evening of Thursday, September 17, some of the facts concerning which may be worthy of record in Science. I was an eye-witness of some of the phenomena, as will appear. The general account is gleaned from the newspapers of the following day. On the date mentioned, at about quarter past seven o'clock in the evening, a large and brilliant meteor passed over the whole state of Massachusetts from west to east. According to reports, a large fragment of it dropped into Boston harbor between Apple Island (a small island) and the shore of the town of Winthrop, which

is a few miles north of Boston. This same meteor was seen to pass over the city of Springfield, about ninety miles west of Boston, and according to newspaper reports "its glare lit up the earth as bright as day," "the hissing of the fiery mass could be plainly heard in some sections," it had "a white head and a reddish tail of burning gases." The Springfield accounts state that a few seconds after its passage over that city it seemed to explode into particles which were burned or vaporized before falling to the earth. The Boston account indicated that it parted high up in the air, one piece dropping in a southwesterly direction. The piece that fell into the harbor is described as seeming to be of the size of the full moon. "Several small boats," so one account states, "were observed in the vicinity when one piece dropped into the water near Winthrop." It is unfortunate that if this was the case, the exact spot of the fall was not noted, as the water there is probably not more than a few feet deep, and the fragment, heated (as such bodies are) only externally in their flight, might be found almost intact in spite of its impact with the water. Moreover, it is probable that its velocity was well spent and that the water resistance would so far reduce the speed that it would not even bury itself in the earth below.

My personal observations in regard to this meteor are as follows: While journeying eastwardly from the direction of Pittsfield to Springfield with a party in an automobile we followed the road which runs approximately parallel to the Boston and Albany Railroad tracks east of the town of Huntington. At a point about a mile southeast of that town and about eighteen miles west of Springfield, with a clear sky but somewhat smoky air, we were startled by a very bright illumination of the landscape, like that given by an intense flash of lightning though much more prolonged. On looking upward at once for the cause, our attention was at once fixed upon a brilliant body descending rapidly and almost vertically, and apparently nearly overhead. It appeared to fall into the woods on a hill to the left of us. The light was remarkable as being of a pure and intense greenish blue, which continued at full intensity until the mass was lost to sight in the woods. This fragment of the larger mass which itself continued on east, appeared to me to owe its luminosity to an actual combustion in our air, as its velocity of fall was apparently much too low for it to have been maintained at a high temperature by air resistance. In fact our first impression was that it was falling almost directly upon us or might strike nearby; an impression confirmed by the appearance that although we were moving at moderate speed along a straight part of the road our horizontal direction of view was changing quite rapidly with respect to its line of descent. I am convinced that this was no illusion. The vivid green blue color of the light rendered the effect very beautiful.

It seems to indicate an unusual chemical composition, something which readily burned in the air and which at the same time gave a pure light, spectrum lines in the green and blue, or green-blue only.

ELIHU THOMSON

SWAMPSCOTT, MASS.,
September 24, 1908

DR. W. J. HOLLAND ON THE SKULL OF DIPLODOCUS

IN the second volume of the *Memoirs of the Carnegie Museum,* Pittsburg, page 225, Dr. W. J. Holland has written at considerable length on the skeleton of *Diplodocus.* Most of his original matter is based on the well-preserved hinder part of a skull that was found in Wyoming. On request Dr. Holland kindly sent me this skull for examination, and I have carefully compared it with the skulls of various reptiles, living and extinct. I regret that I find myself at variance with Dr. Holland as regards many of his determinations of bones and foramina in this skull; but it is essential that errors in such important matters be corrected as early as possible.

First of all it may be said that most of the sutures between the bones are far less distinct than they are represented in Dr. Holland's figures, and some of them do not appear to be where they are drawn.

Three pairs of bones forming the side walls of the brain-case have been identified by Dr. Holland as the exoccipitals, the alisphenoids and the orbitosphenoids. As to the exoccipitals, he is right. Nothing whatever is said by him about the prootics, although they are among the most important and constant bones of the reptilian skull. The fact is, however, that the bones regarded by our author as the alisphenoids are in reality the prootics, while his orbitosphenoids are the alisphenoids. The orbitosphenoids are only slightly developed and are thoroughly consolidated with the alisphenoids. That the bones called by Dr. Holland the orbitosphenoids are in fact the alisphenoids is shown by the presence of the optic foramina in front of them.

Dr. Holland has represented the supraoccipital bone as occupying a small lozenge-shaped area on the upper surface of the skull and narrowing to a point right and left. Now, in all reptiles this bone, by virtue of its epiotic element, takes an essential part in the formation of the internal ear, containing, as it does, the posterior semicircular canal. It must, therefore, come into contact with the exoccipital and the prootic not far above the fenestra ovalis. The three bones concerned are, in the Pittsburg specimen and all others known, thoroughly coossified and the sutures are nearly effaced. However, the writer believes that the suture between the supraoccipital and the exoccipital starts about 25 mm. above the fenestra ovalis and runs outward and backward to a notch in the hinder border of the posttemporal fossa. In Dr. Holland's figure 5 this suture would start from the suture ascending at the left of the letters *ex.o*, at the upper border of the postfrontal bone and run backward just below these letters, and end under the bone *sq*. The suture between the prootic (Dr. H.'s alisphenoid) and the parietal falls so low that it would properly be hidden behind the postfrontal. The line representing the hinder border of the parietal in the supratemporal fossa is, in that figure, directed too far to the rear as it descends. The letters *ex.o* lie on the supraoccipital. On the upper surface of the skull, the suture between the supraoccipital and the exoccipital probably starts on the midline, as represented by Dr. Holland's figure 4, and runs outward to the notch already mentioned and seen near the letters *AS*. The supraoccipital is thus given the importance that it has in the reptilian skull.

Dr. Holland has correctly identified the olfactory, the optic and the hypoglossal foramina, likewise that giving entrance to the internal carotid artery; as to the others, I believe that he is in error. The foramen assigned by him to the oculomotor nerve is situated between the alisphenoid and the prootic, which is just the place for the trigeminal nerve. Just below this there is, in the Pittsburg specimen, a group of three small foramina which are supposed by Dr. Holland to have given entrance to the anterior branch of the internal carotid. These foramina are below the floor of the brain-case and almost certainly opened into the pituitary fossa; and probably they afforded exit to the ophthalmic artery.

As already indicated, that foramen which Dr. Holland has identified as that for the trigeminal nerve is regarded by myself as the fenestra ovalis. It lies on the boundary between the prootic and the exoccipital, where the fenestra ovalis is to be sought. It is a trilobate opening, but in a specimen in the U. S. National Museum the anterior lobe is cut off by a bridge of bone. Here probably escaped the facial nerve. The base of the stapes was no doubt placed in the remainder of the opening.

The foramen for the internal carotid artery lies in the exoccipital near its anterior border. Just behind this comes the foramen called by Dr. Holland the fenestra ovalis. While not believing it to be this fenestra I can not, in the present condition of the skull, say with certainty what was its function. It seems probable that here, as in some other reptiles, the ninth nerve passed out through this foramen separately from the tenth nerve. The latter certainly escaped through the foramen marked by Dr. Holland with the Roman numeral IX. in his figures.

In speaking of his supposed fenestra ovalis

Dr. Holland says that he knows of no other opening through which the auditory nerve could escape from the brain cavity; but unfortunately he did not think it necessary to indicate the distribution of this nerve.

The writer knows of no fossil skull that is better fitted for section than the one described by Director Holland. Had it been divided along the median plane and had the matrix then been removed, much valuable information would have been secured. Probably some sutures that do not show on the rough outer surface would reveal traces of themselves on the inner surface; and important suggestions regarding some of the foramina would offer themselves. Especially, it would then be possible to obtain a complete cast of the brain-cavity of this interesting dinosaur.

Two long splints of bone which extend from the premaxillæ to the front of the external nares, joining along the midline, were supposed by Marsh to be processes of the premaxillæ. Dr. Holland regards them as distinct bones and suggests that they are the lateral ethmoids. It would be interesting to learn how the lateral ethmoids could migrate from the prefrontal region and come to lie on the midline in front of the nostrils. It is very doubtful whether the splints are distinct from the premaxillæ.

The bone called the presphenoid by Dr. Holland is the parasphenoid.

As is well known, the nostrils of *Diplodocus* lie far toward the rear of the skull, between the orbits. On each side of the face, far in front of the orbits, there is found a fontanel in each maxillary bone. This opens into the cavity above the pterygoid bones. Dr. Holland suggests that these openings were probably a pair of supplementary nostrils. From what we know about the development of the rectum it is imaginable that a nasal passage might divide into two passages, and that one of these might remain in its place while the other, with its external opening, might migrate to where we find it in *Diplodocus*. But had this happened in *Diplodocus* the nostril that retained its primitive position would be represented by one of the two clefts found near the midline at the front of the long premaxillary splints already mentioned, which clefts, as Dr. Holland says, opened into the nasal passages. If then the maxillary fontanels were also supplementary nostrils, we should have an animal with three pairs of nostrils. As to those in the maxillæ, it would, I think, be difficult to explain their morphogeny. We must certainly look on the proposition as a fanciful one. I see no reason to doubt that the fontanels in the maxillæ were in life filled with connective tissue and covered over by the skin.

In a foot-note Dr. Holland informs us that certain groups of reptiles have no external ears and that *Diplodocus* probably lacked these organs; but we should like to know what reptiles do have external ears.

In nearly all of Dr. Holland's references to the two skulls of *Diplodocus* in the U. S. National Museum he gets the numbers 2672 and 2673 exchanged. Apparently only the reference on page 239 is correct. On page 235 he credits to the U. S. National Museum two specimens that are in the American Museum of Natural History, New York, Nos. 545 and 969.

OLIVER P. HAY

THE SPREADING OF MENDELIAN CHARACTERS

THE point made by Mr. Hardy in his note on "Mendelian Proportions in a Mixed Population" in SCIENCE of July 10, 1908, is a very important one, though it is open to a dangerous misunderstanding. What Mr. Hardy gives us is a mathematical proof that *under the assumptions of Mendelian inheritance* a dominant character does not tend to spread or a recessive character to die out. A *strictly Mendelian* character would not tend either to increase or diminish its representation in a species, unless favored or opposed by selection. This is a mathematical confirmation of the biological evidence that Mendelism has no relation to evolution.

Nevertheless, the proviso of strict Mendelian inheritance robs the demonstration of a truly biological significance and forbids us to rely on it as a protection against the spread of brachydactyly or other abnormal characters in man himself or in our domesticated plants and

animals. In other places I have attempted to show the need of definite recognition of the fact that the transmission of characters is quite distinct from expression.[1]

The spread of a character through a group by transmission does not appear to have any relation to the frequency with which the character comes into visible expression. In their ability to spread through species recessive characters have a distinct advantage over dominant characters. In the presence of an adverse selection a recessive or latent character could continue to spread, even in spite of the elimination of all the individuals in which the character came into expression, whereas a dominant character would be destroyed as soon as its representatives were exterminated.

It is also known that the potency, or power of a character to come into expression, is subject to pronounced changes, even among different individuals of the same stock. Thus one of Professor Davenport's tailless fowls produced only tailed chicks, though the Mendelian reckoning called for large percentages of tailless birds. And yet the tailless character reappeared in Mendelian proportions in the progeny of a son of the same bird.[2]

Thus the biological probabilities regarding brachydactyly are altogether different from the mathematical calculations based on the Mendelian assumption that parental characters are *transmitted* by only half of the germ-cells. The biological indication is that brachydactyly is *transmitted to all the descendants* of a brachydactylous ancestor, and is likely to regain expression, or even to become prepotent, in any generation, near or remote.

O. F. Cook

Washington,
July 16, 1908

[1] "Transmission Inheritance distinct from Expression Inheritance," Science, N. S., XXV., 911. "Mendelism and Other Methods of Descent," *Proc. Wash. Academy of Sciences*, IX., 189. "Heredity Related to Memory and Instinct," *Monist*, XVIII., 263.

[2] "Altogether, out of 200 offspring of this tailless cock, where I expected 90 per cent. tailless birds, I got not one. On the other hand, using some of the same hens with another cock (the son of No. 117), from 50 offspring, where I expected 25 tailless, I got 24 tailless. In No. 117, although tailless, the tailed tendency strongly dominates over taillessness, so that not in the first nor in the second hybrid generation does taillessness appear, and of the Mendelian segregation in the second hybrid generation there is no trace! On the other hand, another cock reveals typical Mendelian phenomena." See Davenport, C. B., 1907. "Heredity and Mendel's Law," *Proc. Washington Academy of Sciences*, IX., 184.

SCIENTIFIC BOOKS

A Text-Book of the Principles of Animal Histology. By Ulric Dahlgren, Assistant Professor of Biology in Princeton University, and William A. Kepner, Adjunct Professor of Biology in the University of Virginia. Pp. xiii + 515. Price, $3.75. New York, Macmillan Company. 1908.

This book is so unlike the usual text-books of human and mammalian histology that it will seem like an entirely new subject to most readers. It comes as a welcome relief from the multitude of text-books which differ from one another only in the order and arrangement of the subjects treated. For many years the comparative method has been recognized as the "saving salt," as Michael Foster expressed it, of anatomy and embryology, but strange to say, few works have attempted to deal with histology from the comparative point of view, and this subject has been adequately treated only in the case of man and of a few mammals. If we except the early pioneer work of Leydig and the incompleted work of Fol, the only works which deal specifically and adequately with the subject of comparative histology are the large manual of Camillo Schneider and this volume by Dahlgren and Kepner, and the present work is, I believe, the first attempt which has been made in English to put histology upon a comparative basis.

The purpose of the authors is clearly stated in the preface to be

> To produce a work that covers the general field of histology, and is not restricted in the main to human and mammalian forms. It is intended to be a work that teaches general principles and

teaches histology as a pure science and for its own sake. It is believed that it will serve as a broad foundation for future studies of morphology and embryology as well as for the medical studies.

The book admirably fulfills the purpose thus outlined. The field which it covers is greater than that of any other existing work on this subject; every phylum in the animal kingdom is drawn upon for illustrative material and in a few cases plant cells and tissues are also considered. A glance at the 470 excellent figures, most of them original, which illustrate the book shows from what a wide field the material has been drawn and how extensive the researches have been upon which this work is based.

Such wealth of illustrative material would inevitably lead to confusion were it not for the fact that general principles rather than specific structures are everywhere kept in the foreground. These principles are in the main the general physiological properties common to all organisms. The authors have shown that even histology may be best treated from the standpoint of the living, functioning organism. After seven introductory chapters dealing with protoplasm, the cell, multicellular organization viewed from the phylogenetic and from the ontogenetic standpoints, mitosis and amitosis, epithelium and glands, connecting, supporting and filling tissues, there are taken up in order, tissues for the production of motion, electricity, light and heat; tissues connected with circulation, sensation, pigmentation, alimentation, ductless glands, tissues concerned with respiration, gas secretion, excretion, protection, reproduction, accessory reproductive tissues and tissues for the nourishment of the young. This summarizes briefly and in a very general way the purpose, method and extent of the work and it must be apparent at once that within the proper limits of such a review as this it is impossible to deal critically with each of these sections of the book. Comment must be limited to the general features of the work rather than to specific details.

One of the fundamental ideas which are set forth in the first chapter and which runs through the whole book is that the cell can produce only substances and that dynamic products, such as heat, light, electricity and motion are the results of the chemical activities of the substances which the protoplasm has formed by its own "vital" activity. The substances thus formed usually appear as granules and are known respectively as "thermochondria," "photochondria," "electrochondria" and "myochondria." Even in the case of other forms of energy which can not be certainly referred to any of the four types named, the authors are apparently inclined to follow this same idea, and accordingly the granules of the nerve cells are called "neurochondria." The treatment accorded these types of energy and their production by animal tissues is particularly striking and valuable. Other histologies deal with the tissues concerned with the production of motion, but no other text-book deals so fully and satisfactorily with the production by animals of heat, light and electricity. In the treatment of practically every topic touched upon in the book the broadening influence of the comparative method is shown, and most of the illustrative material figured and described is new. Indeed, the work as a whole is much more than a text-book, for it contains a large amount of original observation here published for the first time. This applies to every chapter, but particularly to those which deal with the production of light and electricity, and with the sense organs. However, owing to the fact that investigators' names are rarely mentioned it is difficult for one not thoroughly acquainted with the subject to distinguish between the author's researches and those of others.

In the opinion of the writer the most serious criticism of the work for use as a text-book is that it "falls between two stools"; it can be used advantageously only by advanced students who have had a pretty thorough training in zoology, while much of the material described is quite inaccessible to average classes. This makes the book valuable as a reference work and for use with advanced students, but for this purpose it should be more detailed in character and should include a more extensive bibliography

with references to the principal literature. No general bibliography is given, on the ground that it would necessarily discourage rather than stimulate the student, but the writer has found in reading the book that a larger number of references to special papers and to general works would have been helpful and desirable. The references given are not always definite nor exact.

Now and again throughout the book a kind of teleology appears, which in the present state of biological science it is best to avoid, although it is often difficult to do so; *e. g.*, on page 102, it is said that "muscle must be developed wherever needed," again, on page 142, "heat production is stimulated by its need," etc.

The terms employed are sometimes open to criticism; thus on page 174 "perception" is given as a function of the nerve cell where only irritability or sensitivity is meant; sometimes the style and grammar used are not above suspicion, and in places the malevolence of the printer's "devil" is manifest, as on page 233, where a discovery of the brothers Sarasin is attributed to the Saracens.

However, in view of the many excellences of the work it seems almost ungenerous to call attention to these minor defects; they are slips which we may expect to see corrected in future editions of the book.

When one considers the narrow, technical training which students in histology usually receive, whether they be medical students or not, one can not but wish that a course similar to that outlined in this book might be given in every college and university.

E. G. Conklin

Anthropological Publications of the American Museum of Natural History for 1907–1908

The anthropological publications of the American Museum of Natural History, during 1907 and 1908, comprise Volume I., and Part I. of Volume II., beginning a new series entitled *Anthropological Papers of the American Museum of Natural History;* the closing sections of Volumes XV., XVIII. and XVIII. of the Museum *Bulletin;* and the last part of Volume III. of the Museum *Memoirs:* eleven papers with an aggregate of 1,099 pages, 82 plates and 373 text figures. Formerly minor anthropological papers were published in the annual Bulletin, primarily designed for biological publications. By the segregation of these papers and their issue under a distinct title the Museum has made a change for the better.

Volume I. of the Anthropological Papers opens with Mr. Charles W. Mead's "Technique of some South American Featherwork" (pp. 1–18, pls. I.–IV., 14 figs.). In two distinct sections, the author describes the feather-technique of the ancient Peruvians and of the modern natives of South America. The most striking difference between the two is found in the mode of attaching feathers: the Peruvians employing knots while the modern Indians substitute a loop or simple turn about the shaft.

In Part II. (pp. 19–54, pls. V.–VII., 26 figs.) Dr. Clark Wissler discusses, "Some Protective Designs of the Dakota." The shields or shield-covers of the Dakota were formerly painted with designs, derived from supernatural experiences which imparted to them supernatural efficacy. On modern shields, the thunder, lightning and spider symbols play an important part; but there is evidence for the greater prominence in the old days of simple circular designs representing the heavenly bodies. The designs on supposedly bullet-proof shirts, worn in the ghost-dance, are characterized by a tendency to represent animals, such as turtles, believed to be proof against missiles. While the use of these garments is modern, the author insists on the aboriginal character of protective designs, long antedating, as they do, the outbreak of 1890. In his conclusion the author explains the animistic basis on which interpretations of designs rest, notes the psychologically interesting predominance of animal motives, and mentions the coalescence of apparently incongruous power-symbols as representations of the same natural forces.

Parts III. (pp. 55–139) and IV. (pp. 141–282, pls. VIII.–XIII., 44 figs.) embody Dr. A. L. Kroeber's fairly representative collection

of "Gros Ventre Myths and Tales," and his "Ethnology of the Gros Ventre." In the latter paper the author gives an historical account of the tribe, followed by brief notes on the material culture and an extended treatment of decorative art and ceremonial life. While their ceremonial organization is in many respects similar to that of the Arapaho, the Gros Ventre seem to be unique among Plains tribes in having the same ceremony performed by *several* distinct companies of men of approximately the same age, each of these societies bearing a nickname independent of the character of its dance. Perhaps the chief interest of the paper centers in its comparative analysis of the decorative styles of Northern Plains tribes. In their embroidery designs, the Blackfoot prove to be the most clearly differentiated tribe—distinct alike from the Sioux-Assiniboine and the Arapaho-Ute-Shoshone groups; while neither Gros Ventre nor Cheyenne seem to have developed an individual style. In parfleche painting, the author distinguishes three types of decoration, basing his classification on the relative prevalence of square and triangular units. The employment of coordinate square and triangular elements is noted as a diagnostic peculiarity of Shoshone parfleches, the subordination of triangular to square forms occurs rarely, though, in all these tribes, while in all but the Shoshone an exclusively triangular style predominates.

"The Hard Palate in Normal and Feeble-Minded Individuals" (Part V., pp. 283–350, pls. XIV.–XXII., 8 figs.) sums up the results of a comparative anthropometric study by Drs. Walter Channing and Clark Wissler, based on large series of casts of the palates of mentally normal and abnormal individuals. The most important result is that the general type of palate, as determined by average measurements, is the same for feeble-minded and normal individuals; while the palates of feeble-minded individuals are somewhat more variable. The significance of this difference is, however, negatived by absence of clear differences in the correlation of dimensions for the two groups.

Volume I. closes with Mr. M. R. Harrington's "Iroquois Silverwork" (pp. 351–370, pls. XXIII.–XXIX., 2 figs.). Silver ornaments of Iroquois make date back as far as the end of the seventeenth century, apparently superseding those of copper and brass. The author describes silver ornaments still found, silversmith's tools, and the process of manufacturing several classes of objects. While admitting European influence, he is disposed to regard many of the ornamental patterns as of native origin.

Volume II. opens with Dr. Clark Wissler and Mr. D. C. Duvall's "Mythology of the Blackfoot Indians" (pp. 1–162). The tales are grouped under five headings: tales of the Old Man; star myths; ritualistic origins; cultural and other origins; and miscellaneous tales. In his introduction, the senior author shows by comparison with Central Algonkin mythology that, irrespective of the present conception of Old Man as a trickster pure and simple, the cycle probably represents the basic beliefs of the Blackfoot. The ritualistic myths exhibit a somewhat puzzling variability as compared with the rigid inflexibility of the correlated ceremonial practises. While in a majority of these stories the relation of myth and ritual is fundamental, there are others in which the origin of a ceremony is only episodically interwoven with the body of the tale. Dr. Wissler notes that, in the latter case, the plot is, as a rule, common to several other Plains tribes; while ritualistic tales proper are almost all confined to the Blackfoot. The primarily ritualistic myths are apparently older; and it seems as though in accordance with a wide-spread psychological tendency, rituals of relatively recent introduction from without had become secondarily associated with tales, usually also of foreign origin, which thus came ostensibly to account for the origin of the ceremonies. From a comparative point of view, the author calls attention to special points of contact with the western Cree and the Crow, as well as to the occurrence of significant resemblances to tales of the Arapaho and Gros Ventre.

During the year 1907 the final papers in three volumes of the *Bulletin* and one volume of the *Memoirs* were issued. Professor Franz

Boas's "The Eskimo of Baffin Land and Hudson Bay" is concluded in Part II. (pp. 371–570, pls. V.–X., figs. 173–269) of Volume XV. of the *Bulletin*. Material gathered by a number of independent observers is shown to yield corroborative evidence for the author's previously expressed conviction that Eskimo culture from Alaska to Greenland formed originally a firm unit; and that differentiations are due to local causes, such as the influence of the coast and Yukon River Indians on the Alaskan Eskimo.

Part V. (pp. 381–498, pls. LIX.–LXXII., figs. 68–118) of Volume XVII. of the *Bulletin* consists of Dr. Roland B. Dixon's monograph, "The Shasta," closely patterned in general mode of treatment on his description of the Northern Maidu. The Shasta are found to share part of their material culture with the tribes of northwestern California, but are fundamentally distinct in religious and social life. A relatively close connection with Oregonian culture is hypothetically advanced.

In Part IV. (pp. 279–454, pls. LVII.–LXXXVIII., figs. 103–180) of Volume XVII. of the *Bulletin* Dr. Kroeber discusses the religious life of the Arapaho. The sun-dance of the northern Arapaho of Wyoming is compared and found essentially identical with that of their southern congeners in Oklahoma, and there is a brief account of old tribal customs. This is followed by a detailed treatment of modern ceremonial objects with descriptions of the crow-dance and the peyote cult, which have superseded the ancient ceremonial organization. After discussing number and color symbolism, the author concludes with a sketch of individual relationship to the supernatural.

Part IV. (pp. 327–401, pls. XXIV.–XXVII., figs. 536–592) Volume III. of the *Memoirs* contains two papers—Lieutenant George T. Emmons's "The Chilkat Blanket" and Professor Franz Boas's "Notes on the Blanket Designs." Emmons describes in detail the process of weaving the ceremonial robe, once characteristic of all the North Pacific coast tribes, but now confined to the Chilkat, a branch of the Tlingit. Boas describes the disposition of design units in the Chilkat blanket, showing that the ornamentation is not influenced by the technique of weaving, but is bodily derived from the decorative surfaces of painted pattern-boards.

Robert H. Lowie

BOTANICAL NOTES

PAPERS ON ARCHEGONIATES

Professor Doctor D. H. Campbell describes in a recent number of *Torreya* some of his experiences in collecting liverworts in Java, "perhaps the most interesting region in the world for the botanical student." On account of the heavy rainfall, and the great range in elevation, from sea-level to an altitude of more than ten thousand feet, the flora is very rich in species as well as individuals. "It is said that there are over fifteen hundred species of trees in the island" which botanists will remember is about double the number we have in North America. In this region Dr. Campbell found the greatest abundance of liverworts, some of remarkable interest.

The same author's paper, "Studies on the Ophioglossaceae" in the *Annales du Jardin Botanique de Buitenzorg* (Vol. VI.) adds materially to our knowledge of the round of life of these low ferns. The prothallia of the two species studied (*Ophioglossum molluscanum* and *O. pendulum*) are "subterranean and normally destitute of chlorophyll." That of the first species is short-lived, while in the second it is "apparently capable of unlimited reproduction by means of detached buds." As to relationship the author says "the nearest affinity of *Ophioglossum* is probably with the *Marattiaceae*, but it is probable that there is also a remote affinity with the *Equisetineae*."

In a later paper on "The Prothallium of *Kaulfussia* and *Gleichenia*," in the same journal (Vol. VIII.), Dr. Campbell describes and figures the prothallium, antheridium, archegonium and embryo of *Kaulfussia aesculifolia* a somewhat rare fern of the *Marattiaceae* found in the Indo-Malayan region. The prothallium is fleshy and more than one cell in thickness except at the extreme margin, and looks much like the game-

tophyte of *Anthoceros*. In the second part of his paper he shows that the prothallium of *Gleichenia* is more or less lobed, and has a massive midrib. The antheridia usually develop first "but continue to form after the archegonia are mature."

In a still later paper, "Symbiosis in Fern Prothallia" (*American Naturalist*, March, 1908), the same author discusses the significance of the presence in many gametophytes of archegoniates of fungal endophytes. He finds that "an endophytic fungus is normally present in the green prothallia of several *Marattiaceae, Osmundaceae* and *Gleicheniaceae*."

MISCELLANEOUS BOTANICAL PAPERS

The successive numbers of the *Fern Bulletin* show that it is another of the botanical journals that from small and humble beginnings has grown to be one of the periodicals that every botanist must have. The editor has certainly succeeded in making it a readable and helpful journal for all who are interested in ferns. It will be especially helpful to every young botanist.

With the September number, the journal long known as *Forestry and Irrigation* changes its name to *Conservation*. Under the old title many of its articles were of much interest to all botanists excepting perhaps some of the narrower specialists, and the editorial indications are that under its new title this botanical interest will be measurably increased. The ecologist will find much of his kind of botany in it now.

Somewhat allied to the foregoing is Mr. Brown's "Arboriculture," in which the editor gives his ideas about trees and tree-growing in simple, non-technical language, helped out by excellent reproductions of illustrative photographs. The writer of these notes classes this among his valued botanical periodicals.

A new journal, *Southern Woodlands*, published by the Georgia Forest Association, has confessedly a narrower field than the two journals just mentioned. However, in the August number R. M. Harper's article on "Some Neglected Aspects of the Campaign against Swamps" will be read by botanists with pleasure, since it calls attention to the fact that the drainage of swamps is by no means always to be commended; to which every botanist will say "amen."

In line with Mr. Harper's paper is one by Professor Herbert Osborn, entitled "Needed: A System of Aquatic Farming," in the *Popular Science Monthly* for July, suggesting a possible increased usefulness of swamps as swamps, by proper treatment without draining them.

That there is no danger of an immediate exhaustion of problems in the field botany of the higher plants in the vicinity of New York City, is well set forth in a paper on the subject in the July number of *Torreya*. It is worth careful reading by all field botanists.

Incidentally the same author suggests an interesting line of work in his paper on "Some Native Weeds and their Probable Origin" in a recent number of the *Torrey Bulletin*.

Professor Headden, chemist of the Colorado Experiment Station, in Bulletin 131 concludes that the continued use of arsenical sprays is the cause of the "black heart" and certain forms of "root rot" of fruit trees.

RECENT PAPERS ON FUNGI

Professor Atkinson, in a paper on "The Identity of *Polyporus 'applanatus'* of Europe and North America" in *Annales Mycologici*, shows that the *Boletus applanatus* of Persoon (1799) was antedated by *Boletus lipsiensis* of Batsch (1786). Other specific names, as *megaloma* (Lev. 1846), and *leucophaeus* (Mont. 1856), are shown to be synonyms. Finally he shows that Karsen's genus *Ganoderma* probably should include this very common large bracket fungus, so that its name should be *Ganoderma lipsiensis* (Batsch) Atkinson.

Doctor Clinton's Report of the Station Botanist of the Connecticut Experiment Station for the year 1907 contains notes on fungous diseases for the year, a paper on the root-rot of tobacco, and a longer one on certain heteroecious rusts. The report is excellently illustrated.

Several important papers on fungi appear in the Twenty-first Annual Report of the Nebraska Experiment Station, viz., "Some Tomato Fruit-rots during 1907," by Miss V. W. Pool, with ten plates; "A New Form of Sphaeropsis on Apples," by Miss L. B. Walker, with ten text illustrations; "Seed Treatment for the Smuts of Winter Barley," by Dr. F. D. Heald, with four text illustrations; "The Mold of Maple Syrup," by Dr. F. D. Heald and Miss V. W. Pool, with seven text illustrations; "A Rot of Grapes due to *Pestalozzia uvicola*," by F. A. Wolf, with one plate.

An excellent popular description of the "Smuts of Sorghum" by Dr. E. M. Freeman and H. J. C. Umberger is published by the United States Department of Agriculture as Circular No. 8, of the Bureau of Plant Industry.

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GEOLOGY AND RADIOACTIVE SUBSTANCES

A paper of uncommon interest, particularly to geology and geophysics, has just appeared as a *Bulletin of the Geological Society of America* (vol. 19, pp. 113–146). The author, Dr. George F. Becker, of the U. S. Geological Survey, has brought together the physical data upon radioactive substances, reviewed them carefully for the information of any to whom they are not familiar, and then discussed their bearing on the solution of some of the great questions of terrestrial and cosmogonic history.

Assuming that the relation now established between helium, radium and uranium points to the common origin of the chemical elements, Dr. Becker calls attention to the fact that only helium, hydrogen and nebulium have been identified in the nebulæ, and that an orderly progression can be noticed in the atomic weight of the identifiable elements found in the stars. "Helium stars pass by the finest gradations into hydrogen stars of the Sirian type and these again into Solar stars" which contain elements of atomic weight as high as barium (137.4). The spectroscope has never indicated the presence of uranium in any celestial body, in the sun, or in meteoric matter, although helium is widely distributed. Furthermore, the uranium and thorium minerals on the earth are confined to the pegmatitic facies of the granites and syenites. There is, therefore, abundant incentive for a comprehensive investigation of a direct evolution of the elements from lowest to highest atomic weight, and the progress of this evolution will bear the closest relation to the evolution of our present earth.

Dr. Becker does not believe that inferences as to the age of the earth are competently drawn from the ratio of uranium to helium or to lead in particular minerals (Rutherford, Boltwood). Neither does the assembled physical evidence indicate that the high temperature of the interior of the earth is due in any considerable part to radioactivity (Dutton), though perhaps one tenth of the surface temperature gradient may be of such origin. This would accord with the determinations of the earth's age—not far from sixty million years—made by methods independent of the surface temperature-gradient, including his own discussion of a cooling globe printed in Science last February. There are definite limits of depth below which radioactive matter can not be expected and there is a conspicuous absence of uniformity in its distribution, the concentration in the ocean beds being particularly important.

Dr. Becker closes with a new and ingenious theory of the formation of granite which undertakes to account for the enormous energy content of the radioactive group of minerals. Supposing the earth to have sometime presented a surface of rhyolitic or trachytic magma, it may be supposed to have solidified under stable conditions at about 1,300°, surrounded by its atmosphere of water vapor far above the critical temperature of water. It is now assumed that granite must have formed by the surface action of water vapor (aqueo-igneous fusion) upon the rhyolitic or trachytic mass and that the temperature must have fallen below 800° for the stable formation of quartz. In the interval there must have been opportunity for a tremendous potentialization of energy near the

surface. What offers a better repository for this than the formation of elements of high atomic weight which would then constitute with the granite a surface layer of limited thickness or a radioactive shell, as Dr. Becker terms it?

The whole paper is of extraordinarily suggestive character, not only in the direction of pure speculation, where but scanty data can ever be gathered, but in offering several points of contact with direct laboratory measurement.

ARTHUR L. DAY

SPECIAL ARTICLES

PREGLACIAL DRAINAGE IN CENTRAL-WESTERN NEW YORK[1]

THE present drainage in central-western New York is to the north. The principal river is the Genesee, which traverses the entire state from the Pennsylvania line, beyond which it rises, to Lake Ontario. Its principal tributary is the Canaseraga, which joins it below Mount Morris.

Throughout Allegany County, the Genesee flows in a comparatively broad and open valley with sloping drift-covered sides, and with more or less drift-filling in its bottom. In a few places the bed rock shows in the river bed, indicating that the drift-filling in the bottom of the valley is not deep. The middle portion of the river lies in a series of gorges, with a total length of about 20 miles. The first of these gorges begins opposite Portageville, and in it occurs the upper Portage falls, about 70 feet high. Beyond this the river passes across an ancient drift-filled valley, the rock floor of which lies nearly at the level of the present river below the upper falls. A partial reexcavation of this valley has produced Glen Iris. Having crossed the ancient valley on its rock bottom, the river drops a further 100 feet, cutting a gorge into the northeastern rock wall of the ancient valley to a depth of 365 feet. A mile and a quarter beyond this, the river again emerges into an ancient drift-encumbered valley, into the rock floor of which it has incised a narrow canyon. Just before this ancient valley is reached, the river makes a final drop of nearly a hundred feet, in the lower falls. The Genesee is thus incised at the lower falls about 250 feet below the rock bottom of the ancient valley which it crosses at Glen Iris. The distance between the two points is a mile and a half. The bottom of the gorge below the lower falls is likewise nearly 200 feet below the rock bottom of the ancient valley at that point. The two ancient valleys thus crossed by the modern stream have accordant bottoms. They are, however, two distinct valleys which join opposite Portageville, where the system of gorges begins. We will speak of these ancient valleys as the Glen Iris Valley, and as the Lower Falls Valley, respectively. The name Upper Genesee Valley is given to the open valley in which that river flows from its source to Portageville. The Glen Iris Valley and the Lower Falls Valley unite southward, and from Portageville south are continued as a single valley in the Upper Genesee Valley. A third narrower drift-filled valley joins the Upper Genesee Valley at this point, its mouth being at the head of the first of the postglacial gorges. Thus three ancient valleys, now drift filled, unite at Portageville, one from the north (Lower Falls Valley) a second from the northwest (Glen Iris Valley) and a third from the west. These valleys are con-

[1] Abstract of a paper presented before the New York Academy of Sciences, Section of Geology and Mineralogy, December 2, 1907. Read by title, Albuquerque meeting of the Geological Society of America, December 31, 1907. Only the main points are here discussed; the complete paper, which will appear shortly, will contain a detailed discussion of the critical points of the region. Since the manuscript of this paper was submitted (January, 1908) Fairchild's discussion of the drainage of this region (Bull. N. Y. State Mus. 118, January, 1908) and Spencer's "Evolution of the Falls of Niagara" (Can. Geol. Survey) have been received. In both the northward drainage systems are defended. Fairchild treats all the valleys as obsequent streams tributary to a westward flowing Ontario River, while Spencer reasserts the existence of his Laurentian River. These papers will be fully considered in the more extended discussion of this subject now in preparation.

tinued southward in a single valley about a mile wide (Upper Genesee Valley), which is only slightly clogged by drift.

Beyond the Lower Falls, the ancient valley is obscured by drift, yet not to the extent of becoming untraceable. The modern river makes a detour through the High Banks gorge, the walls of which are over 500 feet high. At St. Helena, four miles to the north of Portageville, the modern river again enters the old valley and continues in it for about 10 miles, flowing northeasterly. This St. Helena valley is clearly the northward continuation of the Lower Falls Valley, the old connection being drift filled. This course of the ancient valley (now partly reoccupied by the Genesee), from St. Helena to the Lower Falls, and thence in a direct line to Portageville, was outlined by Hall in 1842. Several miles above Mount Morris the modern river leaves this ancient St. Helena Valley, and has cut a fourth short gorge. At Mount Morris the modern river enters at right angles, from the west, a broad open valley nearly three miles in width and with a rock bottom 190 feet below the river level, and therefore more than 600 feet below the rock bottom of the ancient valleys first described, and more than 650 feet below the rock bottom (as tested by borings) of the Upper Genesee Valley at Portageville less than twenty miles away. In this broad and deep ancient valley, to which the present author fifteen years ago applied the name Preglacial Canaseraga Valley, the Genesee continues for thirty-five miles to Rochester, where it enters the Rochester gorge with its three falls. The preglacial Canaseraga Valley, which contains the Genesee flats north of Mount Morris, is continued southward as an open valley for fifteen miles to Dansville, beyond which it is choked by drift. The modern Canaseraga follows this valley to its junction with the Genesee at Mount Morris. This valley is clearly an independent valley, parallel to the Upper Genesee Valley, and cut by an independent stream as suggested by the author in 1894. There is practical unanimity of opinion on this point. The question at issue is: was this a northward or a southward flowing stream? It is generally held that this was a northward flowing stream, and that the Genesee, also a northward-flowing stream in preglacial times, joined the stream of this valley south of Mount Morris, by way of the broad Nunda Valley. The present Nunda River enters the Canaseraga Valley through a rock gorge. A careful examination of the banks of the Canaseraga Valley from Mount Morris southward, shows rock exposures everywhere, the lowest of which are more than 200 feet above the present bottom of the Canaseraga Valley. *The Genesee could not enter this valley except by a narrow gorge.* Moreover, unless it is assumed that the Canaseraga Valley was deepened by glacial erosion to the extent of 600 feet below its original depth, the Genesee could not be its tributary, since the old rock floor of the Genesee Valley is more than 600 feet above that of the Canaseraga Valley, the distance between the two being not much over fifteen miles along the supposed ancient course.

Attention is now invited to the Glen Iris Valley. This is half a mile or more in width, and 250 feet deep. Evidently such a valley could only have been cut by a stream of some length. If the Genesee flowed northward by way of the Nunda or some other channel, this valley must have been that of a tributary stream, unless it marks the path of the northward-flowing Genesee itself, as formerly suggested by the author. In any case this valley must have been continued far beyond Glen Iris. It is filled by local drift. For ten miles northwest from Glen Iris the country is flat and deeply drift-covered. Then we come to the Warsaw Valley, an ancient valley extending northwestward, and later bending to the north. At the bend north of Warsaw, another ancient valley, the Dale Valley joins it from the northwest. The junction is somewhat obscured by drift, but can be traced. The Dale Valley at its junction with the Warsaw Valley is as broad and deep as anywhere along its course. It is evidently a tributary valley. If the Warsaw Valley was cut by a northward-flowing stream, two streams, one from the southeast, and the other from the northwest came together at Warsaw in exactly opposite

directions, and continued northward. The Dale would thus turn an angle of over 135 degrees, coming from the northwest, and turning north. Truly a remarkable course for a well-adjusted stream, though not an impossible one. On the hypothesis of a southward drainage, the Dale from the northwest and the Oatka from the north, united opposite Warsaw, and continued southeastward after the approved manner of normal streams. On this hypothesis we must look for a southeastward continuation of the Warsaw River formed by the junction of the Dale and Oatka. For ten miles the country is drift-covered, then we come to the Glen Iris Valley, which is exactly in line with the course of the Warsaw, and which, as we have seen, requires a northwestward continuation. This then is furnished after an interval by the Warsaw Valley, while conversely the Warsaw Valley finds its southeastward continuation in the Glen Iris Valley. Each finds its complement in the other, the requirements of each are fulfilled by the other. The only unknown quantity is the drift-filled interval between Glen Iris and Warsaw. Thus a southward drainage for the Preglacial Warsaw and its two tributaries, the Dale and the Oatka, and their junction with the Genesee at Portageville, explains all the known phenomena, and there are none known which oppose such an explanation. On the hypothesis of a northward flow of the Warsaw, many known facts are unexplained, many are opposed to it, and the drainage takes on a most complicated manner, instead of the simple direct course of a southward-draining system.

One of the chief objections to the hypothesis of southward drainage of the Warsaw and its tributaries is the greater depth of the Warsaw over the Glen Iris Valley. This difference finds a very simple explanation in the hypothesis of glacial deepening of the Warsaw Valley. Is there any evidence of such deepening? There is the most direct evidence. The sides of the Warsaw Valley are much steeper than those of ancient valleys not deepened. At the aforementioned bend of the valley opposite Warsaw, the west or concave bank is almost precipitous. It is here that a valley glacier would produce the greatest erosion. The drift in the southern part of the valley and between it and Glen Iris, is local, composed of the material gouged out of the valley. But the most conclusive evidence of glacial deepening of the Warsaw Valley is the junction of the Dale Valley. This, as has been said, is as broad and deep at its junction with the Warsaw Valley, as anywhere above. But its rock bottom is nearly 200 feet above the rock bottom of the Warsaw Valley. It is thus clearly a hanging valley, and the only explanation of this relation would seem to be glacial deepening of the Warsaw valley by ice. This removes the only known objection to the southward drainage of the Warsaw system.

Considering the southward drainage of the Warsaw system into the Genesee at Portageville as proved, we must next note that the stream which formerly occupied the St. Helena-Lower Falls valley, and into the floor of which the modern Genesee has incised its bed, was also a southward-flowing stream. This is generally accepted, and was, I believe, first pointed out by Fairchild. It could indeed be interpreted in no other way, since it was very evidently not the path of the ancient Genesee. As has been shown, a third ancient valley of smaller size joined the Genesee from the west. Thus three southward and eastward flowing streams united at Portageville. If the Genesee was a northward-flowing stream, and the combined system flowed out to the Canaseraga Valley by way of the Nunda Valley, a complicated system existed, with the streams turning back in direction upon themselves. Moreover, in that case the Canaseraga Valley was deepened by ice to the extent of 650 feet. That it was glacially deepened to some extent will be shown later to be the case, but the evidence is clear that such deepening was not more than half the amount required by the hypothesis of northward drainage, and probably much less.

On the hypothesis of southward drainage of the Genesee, the Nunda Valley must be regarded as that of a southwestward-flowing tributary of the Genesee. Its junction with

the Genesee was about five miles south of Portageville, where now an immense drift barrier exists. The great apparent width of the Nunda Valley, much wider than the Genesee Valley, which has led almost all observers to accept it as the preglacial continuation of the Genesee, following Hall, is readily understood, when it is seen that the valley is worn out on the strike of the strata, and is therefore of the subsequent or inner lowland type. It lies at the junction of the soft Portage shales and the overlying hard Chemung sandstones. The latter form a cuesta inface, which rises several hundred feet above the top of the northern boundary of this broad and rather indefinite valley.

Coming farther south, we find an ancient valley joining the Upper Genesee Valley from the northwest, at Caneadea, where the present river makes a sharp bend. Still farther south, near Angelica, the ancient Black Creek joined the Genesee in a broad valley from the northeast. That the drainage, if southward, continued in the Genesee Valley to Wellsville, and beyond across the Pennsylvania line, and perhaps to the Susquehanna, seems to be indicated by the broad character of the Genesee Valley to within a short distance of the state line. The country beyond this point is deeply drift-covered, for we are near the terminal moraine. That this direction was not the one permanently followed by a southward-flowing stream is indicated by the much broader and more open valley which branches off from the Genesee Valley near Belfast, and which is followed by the Pennsylvania railroad to Cuba and Olean. This valley is as broad, open and deep as is the Genesee Valley. It is a very ancient valley cut into the hard Chemung rocks, and maintains its integrity all the way to the Alleghany at Olean. It is true that south of Cuba the valley is narrower, but this corresponds exactly to the nature of the rock. Near Cuba comes in the heavy Cuba conglomerate lentil, and a little south of Cuba this forms the bottom of the bank on either side. It is here that the narrowest part of the valley begins, perhaps half a mile to three quarters of a mile at the bottom, though over a mile at the top. This continues until the dip carries the conglomerate below the valley bottom, when the valley widens out again. This Cuba outlet forms an excellent one for a southward-flowing Genesee, to the Alleghany and thence to the Ohio, and the Mississippi. On the hypothesis of a northward-flowing stream, a divide must have existed somewhere in this Cuba Valley, unless the Alleghany and perhaps the Ohio also flowed north through the Genesee Valley. Then we are confronted with the remarkable fact that the valley at the divide is as deep and almost as wide and fully as well defined as at any other part. Regarded as the pathway of a southward-flowing tributary of the Alleghany, which, gnawing headward, finally tapped the Genesee at Belfast and diverted it into the Alleghany, all its characteristics are readily explained, and it becomes a part of a normal southward drainage system, of which all the features are normal and perfectly comprehensible. All that is required is a moderate tilting of the land as a whole, an elevation on the north, and a depression towards the south. That there is abundant independent evidence of such tilting is well known, and will be considered again. It will be shown farther on that the relation of these valleys to Lake Ontario is such that only a southward drainage can explain it.

Turning now to the Canasaraga Valley and its tributaries, we find that it constitutes an independent system, which in preglacial time had no connection with the Genesee. The valley south of Mount Morris, at which point the modern Genesee enters it, is as broad and open as above, in some places even broader, though its sides are steeper owing partly to the harder strata in which they are cut. The preglacial Canaseraga, then, which cut the southern part of the valley, was also fully competent to cut the northern part, without the aid of the Genesee River. As at present constituted the Canaseraga Valley is more than twice as wide as the Upper Genesee Valley, and its rock bottom is more than 600 feet below that of the Genesee. Evidently this was the master stream of the region, whether northward or southward flowing. From Mount Morris to Dansville the direction of the valley

is southeastward, and half way between these two points, it receives a tributary valley from the north, this valley in its upper part being occupied by Conesus Lake. The junction of this valley with the Canaseraga Valley is more or less obscured by drift, but can be readily traced. The former stream of this valley evidently discharged southward into the Canaseraga, and if the course of that stream was northward, we have here a swinging of the waters of the preglacial Conesus through an angle of 135 degrees or more. Since the present northern end of Conesus Lake is only five miles in a direct line from the Canaseraga Valley at the village of Avon, a point twenty miles north of, and therefore, on the supposition of northward drainage, down stream of, the point where the ancient Conesus joined the Canaseraga, it is difficult to understand why a branch of the main stream from Avon did not capture and reverse the drainage, especially since the modern drainage is along that line, and the rocks there are softer than farther south. On the other hand, the hypothesis of a southward drainage, in preglacial times, of the Canaseraga and its tributaries meets with no such difficulties, and the form of the system is a perfectly normal one.

South of Dansville the Canaseraga Valley is filled with drift, the top of which has a nearly constant level between 1,300 and 1,400 feet above sea-level. Since the elevation of the valley bottom at Dansville is 700 feet, the depth of the drift is between 500 and 600 feet. This is mostly local, and its characteristics indicate that a glacier occupied the valley to Dansville, and the discharge from it built up the drift deposits in the valley to the south. This valley, the southward continuation of the valley at Dansville, is fully as broad and ancient as the valley at Dansville. Without change in character, this valley continues south past Burns and Hornell and so along the present Canisteo Valley to the Susquehanna. Any one who has traveled through this region on the Erie railroad, must have noted the well-developed and continuous character of these valleys. If there ever was a divide here between a northward- and a southward-flowing stream, as contended by the advocates of a former northward drainage, this divide was in a valley as broad, as deep and as open as any portion of the valleys of these two streams for fifty miles to the north and to the south of this divide. Of course one might account for the character of these valleys, by assuming that the entire drainage system of the Susquehanna, including that stream as well, discharged northward into the Ontario Valley, but I doubt if any of the advocates of northward drainage would go to such an extreme. The non-existence of divides in these valleys, such as should be expected in a normal drainage system, even though it were developed on an ancient peneplain surface, as we have good evidence to believe was the case with the drainage system under discussion, this absence of divides is in itself almost sufficient to condemn the hypothesis of northward drainage.

South of Dansville, where the ancient valley changes from a southeasterly direction to one a little west of south, the Wayland Valley, of similar width and ancient character, comes in from the east. Five miles east of the junction the Wayland Valley receives the Springwater Valley as a tributary valley from the north, opposite the village of Wayland. Seven miles north of Wayland, this ancient Springwater Valley forks, the two prongs being occupied by Hemlock and Canadice lakes, respectively. Here we have another drainage system, of the southward-draining type, which joins the Canaseraga near Dansville. Such a southward uniting of all the valleys is wholly inexplicable on the hypothesis of northward drainage during its development. The Wayland Valley continues eastward to North Cohocton, without change of character, and with an average width of about a mile. Here it receives another ancient tributary from the northeast. This also forks, and in the western branch lies Canandaigua Lake. The valley of Honeoye Lake comes in here from the north as another ancient tributary valley. The points of junction of these valleys near Naples are obscured by heavy drift deposits, but they are not difficult to trace. They are well shown by the outcrops of the strata delineated on the geological map of the

Naples quadrangle issued by the state survey. Here we have another series of southward-uniting valleys, easily understood as tributary, with other similar series, through the Wayland Valley, to a southward-flowing Canaseraga, but difficult to understand if not inexplicable on the hypothesis of preglacial northward drainage.

If this system drained southward, and there seems to be no escape from such a conclusion, it appears that the Honeoye and Canandaigua system originally drained south by way of the Cohocton to the Chemung and the Susquehanna, but was diverted by capture to the Canaseraga-Canisteo drainage system. Or it is possible that the Canandaigua-Honeoye system originally was tributary to the Canaseraga, and that the Cohocton cut off these more eastern branches from that drainage system, conducting them by a shorter route to the Chemung than is traversed by the more western tributary of the same stream. If that was the case, the capture by the Cohocton was accomplished in comparatively late preglacial time, since the Cohocton Valley is still narrow, though deep. We do not know enough of the elevations of the rock bottoms of these ancient valleys to decide which is the more likely.

On the hypothesis of northward drainage, we are again confronted by the anomalous character of the valleys at the point where a divide should have existed. Dryer has pointed out that the broad, open character of the east and west Wayland Valley is incomprehensible on the hypothesis of northward drainage, such a valley being entirely out of place at the divide of two normal river systems which flow in opposite directions. On the hypothesis of southward drainage this valley is easily understood.

It should be noted in this connection that the rock bottom of the Wayland Valley, so far as it is known from outcrops in the beds of streams south of Dansville, is above that of the Canaseraga Valley, the difference being perhaps 200 feet. Since the valley at Dansville is a thousand feet deep, not counting any drift-filling in the bottom of this valley, this difference is of no great significance, so far as the importance of the valleys is concerned. It indicates a deepening of the Canaseraga Valley by ice. This is further suggested by the steepness of some parts of the banks of the valley at Dansville, and the local character of the drift which partly fills the southward continuation of the Canaseraga Valley.

A glance at the geological and topographical maps of the regions around the other Finger lakes shows that they too have the southward drainage expression. Keuka Lake has two southward-uniting branches, the united valleys becoming tributary to the Cohocton. Seneca and Cayuga Lakes are continued southward in more or less open valleys to the Chemung and Susquehanna. That these and many of the other valleys were more or less deepened and widened by ice erosion is, I believe, pretty generally held in spite of objections raised against this idea. The evidence seems to be overwhelmingly in favor of this explanation of their characteristics.

Let us now consider the evidence which Lake Ontario has to offer in this connection. Opposite the mouth of the modern Genesee, the lake is 576 feet deep. Eighteen miles further east it is 738 feet deep. The surface of the lake is 247 feet above mean sea level. The fall of the Genesee from Mount Morris to Avon is ten feet in a distance of fifteen miles in a straight line but twice that distance by the river. This gives on the average a fall of a third of a foot per mile. The rock-bottom at Mount Morris is 191 feet below the river level; at Cuylerville, four miles to the north, it is 184 feet below that level. At Piffard, four miles farther north, it is 158 feet below the same level. This gives a *rise of the rock floor northward,* of about six feet for the first four miles and of twenty-six feet for the next four miles. The record at Piffard is probably not of the greatest depth, yet the northward rise of the rock floor of this valley seems to be undoubted. Taking the smaller figure, a rise northward of 1½ feet per mile, the rock bottom of this ancient valley at Lake Ontario, forty miles north of Mount Morris, would be 196 feet above the *level* of Lake Ontario, or 772 feet above its floor (934 feet above its deepest part). This

is truly an astonishing relation for a tributary of a river occupying the Ontario Valley. The differences in elevation between the rock bottom of the Canaseraga Valley (modern Genesee Valley) at Mount Morris, forty miles south of Lake Ontario, and the surface of Lake Ontario, is 136 feet; the rock bottom at Mount Morris is 712 feet above the valley bottom of Lake Ontario opposite the mouth of the modern Genesee, and 874 feet above the deepest part of Lake Ontario, seventy miles away. We have seen evidence that the valley at Mount Morris was deepened by ice to the extent of at least 200 feet. This would make a difference of over a thousand feet between the valley bottom at Mount Morris and the bed of Lake Ontario. The advocates of northward drainage will find it difficult to make the preglacial Genesee descend this interval in the space of seventy miles. Nor can they appeal to constant deepening of the valley northward, which would enable us to regard the difference as due to tilting; for we have seen that, instead of declining, the valley bottom rises northward, until on the smallest recorded rise it reaches very nearly the general level of the country about Rochester.

It is thus very evident that the valley of Lake Ontario has been deepened far below that of the Genesee and Canaseraga Valleys. (The rock floor of the Genesee Valley at Portageville, which on the hypothesis of southward drainage is regarded as independent of the Canaseraga Valley, is 1,500 feet above the deepest part of Lake Ontario, the distance between the two points being about ninety miles.) What has produced this excessive deepening? Those who know the region will not consider differential warping as a factor: the dip of the strata scarcely varies over this region. Ice erosion of the Ontario Valley can not be appealed to, since the course of the valley is nearly at right angles to the movement of the ice. (The question of ice erosion of the Ontario Valley has been fully discussed by Gilbert, and more recently by Grabau in the Bulletin on Niagara Falls. Both authors agree that the evidence does not favor the ice erosion theory.) Other explanations, such as deepening by the solution of the limestones are not favored by the facts. The only satisfactory explanation seems to be that Lake Ontario Valley was deepened by normal river erosion. If that is the case, and the preglacial streams of western New York flowed northward, and were tributary to the Ontario River, their valleys should have been deepened in conformity. That they were not so deepened is a powerful argument against the northward flow of these streams.

On the hypothesis of southward drainage first advocated by the present writer, in 1901 (Bull. 45 N. Y. State Museum), and subsequently in this journal, the ancient valleys of central and western New York must be regarded as formed by streams arising in the Canadian region, and flowing across New York. They were gathered in by either the Susquehanna or the Alleghany. This drainage developed upon an old peneplain which beveled the strata, as shown by abundant evidence (this is discussed quite fully by Grabau in Bulletin 92, New York State Museum). The development of this drainage system took place in Tertiary time, when the land in the north stood high, and the Mississippi embayment and the Atlantic coast south of New York were depressed. The evidence for this is well known. The main stream of the region was the Dundas, flowing out through the Dundas Valley at the west end of Lake Ontario. This stream was of the consequent type, and one of its subsequents carved out the broad Ontario Valley as an inner lowland on the soft Siluric and Ordovicic strata. This subsequent stream gradually beheaded the streams flowing across New York, capturing their headwaters, and carrying the drainage to the Mississippi embayment. Such a stream would soon deepen its valley on the soft Medina rocks, and thus the great subsequent deepening of Lake Ontario would be accounted for. This deepening, then, occurred after the valleys of New York were cut, these valleys remaining behind with beheaded southward-flowing streams which were incapable of deepening or widening their valleys any further. Meanwhile short northward-flowing or obsequent streams came into exist-

ence along the southern border of the deepening Ontario Valley. This southern border, partly shown in the Niagara escarpment, must be regarded as the inface of a revived cuesta, of which the Ontario Valley is the inner lowland. Examples of obsequent streams flowing down the inface of the cuesta, and cutting backward from it, are found in the old Saint David's gorge, which had cut back as far as the present Whirlpool; in Irondequoit Bay, often regarded as the former path of the Genesee, but clearly deepened beyond any depth reached by the Genesee or Canaseraga; and probably Sodus Bay. Eastward the Ontario Valley becomes narrower though the flooded portion is wide. The Ontario River headed eastward, probably passing through Oneida Lake from Little Falls, where the divide between the eastward-flowing Mohawk and the westward-flowing Ontario River was situated. At the Thousand Islands occurred another divide, between the northeastward-flowing preglacial St. Lawrence and a southwestward-flowing tributary of the Ontario River. Spencer's Laurentian River, which carried the drainage of all the Great Lake valleys (except Superior) out across the Thousand Island divide, never existed. There is no good evidence for, and abundant evidence against, its existence.

To sum up: The evidence seems to be all in favor of southward drainage in Tertiary time of the streams which cut the Finger Lakes and the other parallel valleys of New York. Many of these were subsequently deepened by ice erosion. Part of this drainage went out by the Susquehanna to the Atlantic, and that of the more western valleys probably to the Ohio and Mississippi embayment. The drainage of the valleys of the Great Lakes also went out in that direction, and the system developed as a normal sequential drainage system on a peneplain surface of nearly horizontal strata. Capture of the headwaters of the New York streams left their beheaded portions in the old valleys which they had not the power to further deepen or widen. The Ontario Valley, however, was deepened without reference to the Finger Lake Valleys. All this occurred while the land in the north stood higher than now, and the Mississippi embayment and the Atlantic coast south of New York, lower, as shown by marine sediments of Tertiary age.

A. W. Grabau

Columbia University,
December, 1907

NOTES ON A SMALL COLLECTION OF SHELLS FROM TEXAS

During part of the month of August, 1906, Mr. A. B. Wolcott, a Chicago entomologist, collected extensively about the region of Brownsville and Corpus Christi, Texas, and incidentally secured an interesting collection of land and fresh-water mollusks. Mr. Wolcott found the river very high and hence was able to do nothing in the way of collecting the Unionidæ. A few fresh-water shells were secured from the river drift. The land mollusks were notably abundant, particularly the Polygyras and the Bulimulæ, as were also the Helicinas and the Euglandinas. No novelties were obtained, but the material seems to be of enough interest to be placed on record. The collection has been presented by Mr. Wolcott to the Chicago Academy of Sciences.

In working up this list constant reference has been made to the excellent paper by Pilsbry and Ferriss, on the "Mollusca of the Southwestern States," II., published in 1906 in the *Proceedings* of the Academy of Natural Sciences of Philadelphia, page 134.

HELICINIDÆ

Helicina orbiculata tropica "Jan" Pfr.

Corpus Christi; tropical forests, Esperanza ranch, Brownsville, on shrubbery; river drift, Brownsville; on beach, Port Isabel.

In a lot of 25 specimens, 5 are partly red and blue and the balance are blue. A common species in this locality.

HELICIDÆ

Praticolella griseola (Pfr.).

Chaparral near Brownsville; old Fort Brown and in river drift, Brownsville; Port Isabel, on beach.

The specimens collected show a wide range of variation in the number and position of the

bands. Specimens from Brownsville are strongly banded, the lower band being very wide or split up into from two to six bands. In one specimen there are two wide, dark, brownish-black bands; in the rest of the specimens the bands are light brown in color.

Praticolella berlandieriana (Moricand).

Sinton, under railroad tie; river drift in Brownsville; Corpus Christi.

Several of the specimens are unicolored and translucent. Apparently a rare species in this locality.

Polygyra texasiana (Moricand).

River drift, Brownsville; under mesquite in house-yard, Brownsville; on beach, Port Isabel; Corpus Christi.

The specimens of *texasiana* collected by Mr. Wolcott show a large amount of variation both in size (7.50 to 13.50 millimeters in diameter) and in the height of the spire, the latter varying from flat to strongly elevated. Several specimens have the aperture modified, a characteristic due to immaturity or disease. Three specimens are without a parietal tooth and one specimen has a single very small parietal tooth and two small tubercles in place of the peristome teeth. The sculpture of the lot of eighty specimens is interesting. Forty-six are typical *texasiana*, 22 are transition forms between this and the next variety and 11 are typical *hyperolia*.

Polygyra texasiana hyperolia Pilsbry.

River drift, Brownsville.

Apparently not common.

BULIMULIDÆ

Bulimulus dealbatus liquabilis Reeve.

Corpus Christi.

Two specimens apparently referable to this race of *dealbatus* were found in a lot of *B. alternatus mariæ*. They are rather corpulent, unicolored and resemble fig. 7, pl. 6, of Pilsbry and Ferriss's paper.[1]

Bulimulus alternatus mariæ Albers.

Sinton, on mesquite; Point Isabel, on beach; Brownsville; Corpus Christi.

The Brownsville specimens show a wide range of variation in color. Eleven are pure white, 29 have the upper whorls streaked, 19 are irregularly striped all over and 2 are plain chocolate colored. Two specimens with streaked spires have a well-developed columellar tooth and several specimens show a thickening in this region. Of the Corpus Christi specimens six have a columellar tooth while seven are without it or have only slight indications of it.

[1] *Proc. Phil. Acad.*, 1906, p. 134.

OLEOCINIDÆ

Euglandina singleyana (W. G. Binney).

Tropical forests, La Esperanza Ranch, Brownsville.

Apparently a common species. The two dozen specimens secured show little or no variation.

PUPILLIDÆ

Pupoides marginatus (Say).

Old Fort Brown, Brownsville.

Typical, but apparently not common.

Bifidaria pellucida hordeacella Pilsbry.

Old Fort Brown, Brownsville.

Very common, associated with the two following species.

Bifidaria procera (Gould).

Old Fort Brown, Brownsville. This is the most common pupa in the Brownsville region. It varies somewhat in corpulency.

Bifidaria contracta Say.

Old Fort Brown, Brownsville. Not particularly abundant.

ZONITIDÆ

It is singular that Mr. Wolcott secured no representatives of this family, as the various species are common throughout Texas.

SUCCINEIDÆ

Succinea luteola Gould.

On mesquite near Brownsville. Very common and typical. Specimens of all sizes were obtained, varying from the young, about 2 millimeters long, to old specimens 16 millimeters in length.

PLANORBIDÆ

Planorbis glabratus Say.

River drift, Brownsville. Several specimens, the majority of which are half-grown, seem referable to this species, which would seem to be distinct from *trivolvis*, the whorls being narrower and the shell generally more polished.

Planorbis cultratus Orbigny.

A single specimen of this acutely keeled *Planorbis* was found in river drift at Brownsville. It measures 3 millimeters in diameter.

Planorbis liebmanni Dkr.

River drift, Brownsville.

Segmentina obstructa (Morel).

In river drift, Brownsville. Numerous and apparently typical.

FRANK COLLINS BAKER

SOCIETIES AND ACADEMIES

THE AMERICAN MATHEMATICAL SOCIETY

The fifteenth summer meeting of the society was convened at the University of Illinois on Thursday and Friday, September 10–11, 1908. The scientific program occupied a morning and an afternoon session on each day. On Thursday evening a social gathering and dinner at the University Club contributed much to the pleasure of the occasion.

The first session was opened with an address of welcome by Professor E. J. Townsend on behalf of the University of Illinois. In the absence of the president of the society, Professor H. S. White, the chair was occupied by Vice-president Professor G. A. Miller, relieved by Professors E. B. Van Vleck and Ziwet. At the close of the meeting resolutions were adopted expressing the society's appreciation of the generous hospitality of the University of Illinois and its officers.

The total attendance at the various sessions was over fifty, including thirty-eight members of the society. Among the visitors present was Professor Max Abraham, of the University of Göttingen. At the meeting of the council the following persons were elected to membership in the society: Dr. G. G. Chambers, University of Pennsylvania; Dr. G. M. Conwell, Yale University; Mr. F. F. Decker, California Polytechnic School; Professor A. E. Haynes, University of Minnesota; Mr. P. H. Linehan, College of the City of New York; Mr. H. F. MacNeish, University High School, Chicago; Mr. Lewis Omer, High School, Oak Park, Ill.; Professor J. C. Stone, State Normal College, Ypsilanti, Mich. Six applications for membership in the society were received. The total membership is now 598.

The following papers were read at this meeting:

Eduard Study: "Zur Differentialgeometrie der analytischen Curven."

L. E. Dickson: "On definite forms in a finite field."

G. A. Miller: "Answer to a question raised by Cayley as regards a property of abstract groups."

Arnold Dresden: "The second derivatives of the extremal integral."

O. E. Glenn: "On the decomposition of forms into quadratic factors."

Louis Ingold: "On the Kowalewski integral."

L. D. Ames: "A method for the approximate solution of n equations in n unknowns."

Oskar Bolza: "Heinrich Maschke: his life and work."

G. A. Bliss and Max Mason: "Fields of extremals in space."

J. B. Shaw: "Qualitative algebra."

Virgil Snyder: "Construction of plane curves of given order and genus having distinct double points."

Arthur Ranum: "The division of riemannian space into congruent parts."

Arthur Ranum: "Parallelopipeds in lobachevskian geometry."

F. L. Griffin: "Families of central orbits related to circular trajectories."

F. R. Sharpe: "The identical relations of the strain and stress components of an elastic solid."

Virgil Snyder: "Surfaces derived from the cubic variety having nine double points in four dimensional space."

L. E. Dickson: "On Fermat's last theorem."

L. E. Dickson: "Rational reduction of two quadratic forms" (preliminary communication).

W. R. Longley: "Note on implicit functions."

E. B. Wilson: "Note on statistical mechanics."

E. J. Wilczynski: "A projective generalization of Meusnier's theorem."

E. R. Hedrick: "On the convergence of the jacobian."

Edward Kasner: "Conformality in connection with functions of two complex variables."

G. A. Miller: "Groups with regard to modular systems."

J. W. Young: "Two-dimensional chains and the classification of complex collineations in a plane (second paper)."

J. H. Maclagan-Wedderburn: "On the direct product in the theory of finite groups."

W. B. Fite: "The class of a group all of whose operations except identity are of order three."

C. N. Moore: "The summability of the developments in Bessel functions, with applications."

E. J. Townsend: "Interchange of order of differentiation."

H. B. Newson: "On characteristic equations."

L. W. Dowling: "The arrangements of the real branches of a plane sextic curve."

C. N. Haskins: "On the second law of the mean."

L. I. Hewes: "Necessary and sufficient conditions that an ordinary differential equation of the first order and nth degree shall admit a continuous conformal group."

The next meeting of the society falls on Saturday, October 31. The San Francisco section held its fourteenth regular meeting at the University of California on September 26. The southwestern section will meet in the Thanksgiving holidays.

F. N. Cole,
Secretary